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ABSTRACT

Stages in the educational facility planning process are presented in this handbook, with a second focus on implementation. Four chapters provide information on the four cycles of the planning process, which include analysis and diagnosis, research and development, planning and programming, and implementation and evaluation. Characteristics of an effective educational building planning policy include adaptation to climatic and topographical conditions, an equally accessible location, implementation according to schedule, and consideration of manpower and resource limitations. The appendix contains an inventory questionnaire. (10 references) (LMI)

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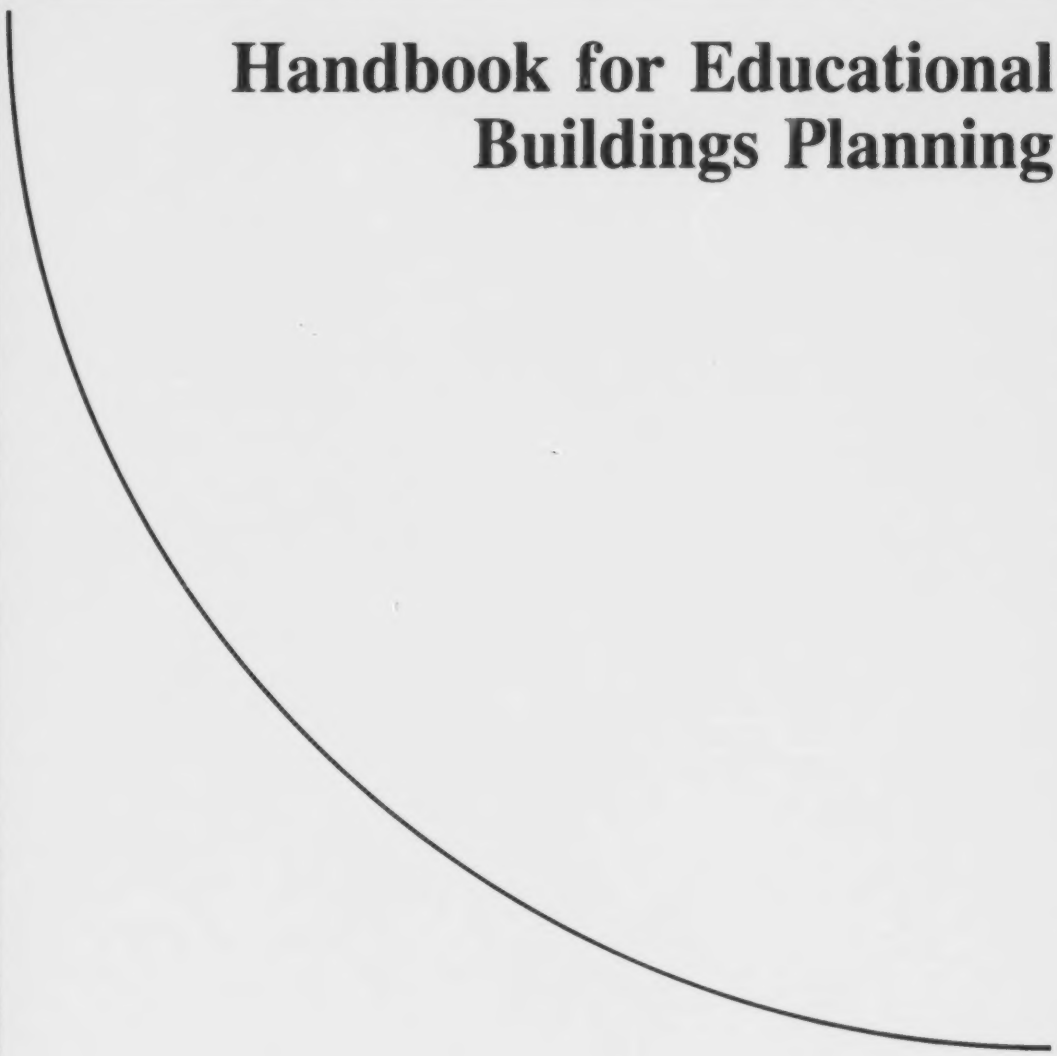
Educational buildings and equipment 9

Handbook for Educational Buildings Planning



Rodolfo Almeida

ED-88/WS/61

TABLE OF CONTENTS

I	INTRODUCTION	1
II	BASIC CONCEPTS	4
III	ANALYSIS AND DIAGNOSIS	7
IV	RESEARCH AND DEVELOPMENT	22
V	PLANS AND PROGRAMMES	57
VI	IMPLEMENTATION	68
APPENDIX		85
BIBLIOGRAPHY		91

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PREFACE

This Handbook was prepared and published (1983) by CONESCAL - Regional School Building Centre for Latin America and the Caribbean - and was subsequently adapted and published in English by the Unit for cooperation with Unicef and WFP as Digest n° XI: "Handbook for Educational Buildings Planning" (1985) as part of their Digest series: "Notes, Comments ... (Child, Family, Community)".

This present edition is published due to its high demand.

Paris, 28 November 1988

I

INTRODUCTION

The purpose of this hand-book is methodologically to present the main stages or cycles in the educational facility planning process and briefly to discuss the tools and means used for such planning. It is designed to provide reference and guidance to those responsible for planning and implementing educational facility programmes in each country.

The handbook should be viewed as a frame of reference within which architects and educational physical plant specialists may situate and direct their own work. Each stage or cycle is not necessarily sequential and the general framework may be entered into at any stage or activity.

Educational expansion and rapid changes in educational demands present urgent challenges in almost all developing countries, but resources are insufficient to meet such demands and costs are rising. Thus, investment in education should be planned with increasingly greater care and results should be optimized insofar as possible.

Since population growth in developing countries has not been followed by comparable economic growth, educational objectives have had to be re-examined and the very basis of their content has had to be restructured. Most countries have thus set out to reform their educational systems and, at the operational level, such reforms have been directed toward the goals of more democratic education, universal primary education, equal access to secondary education and reforms in structure, content and methods.

It is evident that the implementation of educational facilities projects to expand education, generally come up against financial and administrative constraints. One solution to limited funds is to seek external financing, which demands effective support from the country in order

to optimize the concentrated investment. Another solution is the maximum utilization of local material and manpower resources, reductions in administrative processing time for receiving bids, awarding contracts and making payments.

An effective planning policy for educational buildings should make it possible to meet the following objectives:

i) Be appropriate for the educational requirements, for the climatic and topographical conditions in each place, and for possible activities as a community development centre.

ii) Be appropriately located, in accordance with priorities, to ensure the population of equal opportunity for acces to education.

iii) Be implemented within a logical period of time, according to schedules that soundly conform to well-structured building programmes.

iv) Be appropriate for the limitations of manpower and material resources nationally available. *

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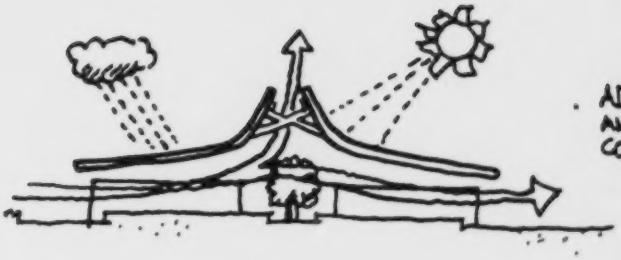
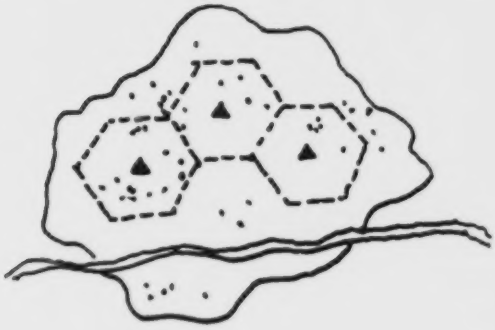
* UNESCO. Report Studies S-80 Planning Educational buildings: Basic Concepts, by Kamal El Jack & Rodolfo Almeida.



. ADAPTATION TO CLIMATIC AND TOPOGRAPHIC CONDITIONS.



. LOCATION ACCORDING TO PRIORITIES THAT PROVIDE THE POPULATION WITH EQUAL OPPORTUNITIES.

. IMPLEMENTATION CALENDAR.

. MAXIMUM UTILISATION OF LOCAL RESOURCES.

II

BASIC CONCEPTS

Planning the physical infrastructure of an educational system or educational facilities planning may be defined as the logical set of means to make it possible to achieve the realistic goals established through educational planning, on the one hand, and on the basis of resources available, on the other. It includes a set of activities aimed at conserving, improving and expanding educational facilities, in addition to optimizing their efficient use in order to meet the short, medium and long-term requirements established through educational planning and socio-economic development plans.

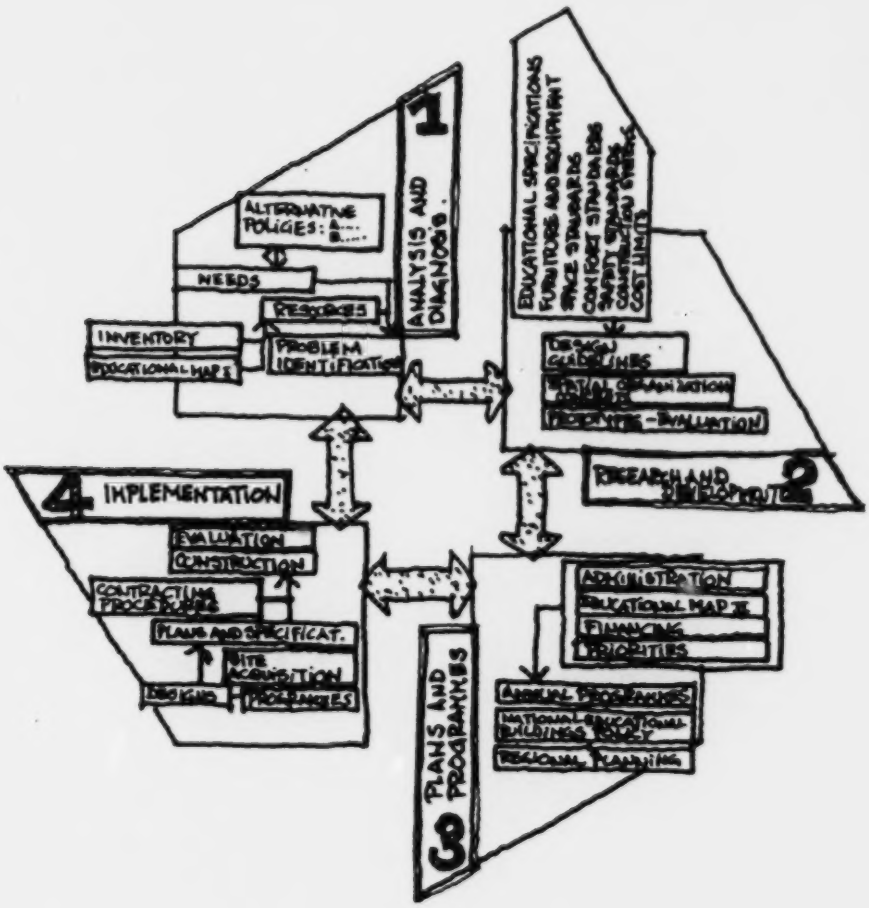
Educational planning is a continuous and systematic process through which qualitative and quantitative goals are established in specific stages, both for individual development and for the social, cultural and economic development of the country. Through such planning educational problems are approached in all their aspects, not as a theoretical concept, but as purpose and policy and an attempt to put such planning into actual practice in the organization, administration and operation of educational services. Such planning can only be effective if it is continuous and comprehensive, that is, if it views the overall problem of education in relation to the social and economic conditions of the country and solves problems on this basis within a set of priorities.

Planning the educational facilities of a system is directed towards allocating resources in precise areas, in addition to the specific use of investments in educational facilities. Establishing priorities in this regard is directly linked to sectoral policies and socio-economic development plans.

The specific objectives of physical planning in education include:

1- establishing investment priorities in educational infrastructures and organizing their

. EDUCATIONAL BUILDINGS PLANNING PROCESS.



application through plans and programmes.

2- *serving as a tool for implementing educational and socio-economic development plans.*

3- *providing suitable physical means for standardized and generalized practice in the educational variables stemming from educational planning.*

4- *programming the sound use and extent of the educational facilities network.*

This document, intended as a model-handbook and based on the UNESCO study previously mentioned, presents the educational facilities planning process in four cycles:

- Analysis and diagnosis.
- Research and development.
- Plans and programmes.
- Implementation and evaluation.

These cycles and their related activities, may be carried out independently, depending on the case and on the level or stage reached in the planning process.

Each of the four cycles mentioned is discussed below and the activities that constitute the cycles are analyzed in greater detail.

III

ANALYSIS AND DIAGNOSIS

Within the educational facilities planning process, the analysis and diagnosis cycle is intended to identify and pinpoint existing problems that arise or are confronted by the educational system when attempting to meet specific educational goals.

The success of an educational plan depends, to a great extent, on the results of the interdisciplinary, co-ordinated team work of different specialists who participate during this stage of the process, such as architects, educational planners, administrators and economists.

IDENTIFYING A PROBLEM in the field of educational facilities means pointing out and describing the quantitative and qualitative difficulties and obstacles that must be overcome in order to reach specific goals of increased school enrolment and appropriate education. Determining the problem, therefore, involves assessing the obstacle in order to gain knowledge concerning its magnitude and importance.

DIAGNOSIS of the physical infrastructure of a school network includes a set of activities that make it possible to evaluate the characteristics of the educational facilities of the network in order to define activities that will facilitate not only its proper adaptation to the requirements established on the basis of educational planning and the demand of the eligible school population, but also the compatibility of its future responses with such requirements.

Diagnosis makes it possible to identify problems and to provide criteria that facilitate setting forth possible alternative solutions, in the first place, and then decision-making regarding such solutions on a rational basis to improve the conditions of the educational system.

An analysis of the DEMOGRAPHIC FACTORS and the physical plant make it possible;

- to define the resources available in the system;
- to indicate crowded conditions when they exist and specify obsolete buildings to alter and,
- to determine the need for establishing new educational facilities, possible expansions, adaptation, reconstruction and substitution of existing facilities.

The process for assessing the physical infrastructure is carried out by applying established standard criteria (parameters for use efficiency, design guidelines and model architectural briefs) to the inventory of educational facilities made on the basis of a general school directory and maps that indicate the location and characteristics of school buildings, precisely coded and classified.

A. EDUCATIONAL POLICY

Educational policy is generally understood as the coherent and organizational set of resolutions adopted by the proper authorities regarding general and specific objectives to be achieved, priorities to be respected, means to be used and educational content.

A number of general guidelines to regulate the educational facilities planning process stem from educational policy and include specifically: sectoral educational development priorities, regional educational service priorities, nuclear planning of educational facilities and services and priorities among specific programmes.

Service and scholastic index goals for different educational levels, established by educational policy through educational planning, are the facility goals that should exist in different locations to optimize the use of the school network.

Such goals usually arise because of the close links between educational planning and resource planning as part of development plans.

Setting educational priorities has an impact on establishing the size of enrolment that should be served at different educational levels, which, when compared with the installed capacity, shows the actual deficit by educational level. Meeting this deficit is the response of physical planning to educational planning.

B. RESOURCE (SUPPLY)

Resources may be classified as human, material and financial. For those responsible for physical planning, knowledge of these resources is necessary. In human resources, they should be familiar with such facts as the type, location and quantity of manpower and professional firms involved in design and construction. In material resources, they should know about matters such as the distribution and inventory of natural materials, plants that manufacture construction elements and components, and construction and transport equipment.

In financial resources, their knowledge should include allocations made by central governments and local authorities to education and, particularly to educational facilities, in addition to special taxes and multilateral or bilateral loans or donations. During this stage, the installed capacity in particular is analyzed.

The INSTALLED CAPACITY of an educational system is understood as the set of all the educational buildings that make up the school network, including furniture, equipment and installations. SUPPLY is understood as the educational facilities that offer services under acceptable conditions.

Efficiency criteria refer to those indicators that make it possible to determine with precision what part of the installed capacity may be considered supply.

C. INVENTORY

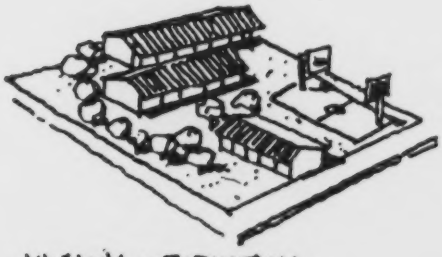
INVENTORY is the activity of physical planning for education that is related to gathering and processing information that will provide comprehensive knowledge of the physical resources in the educational plant.

Its purpose is to provide sufficient, timely and reliable information for subsequent stages in the planning process.

Carrying out an inventory also makes it possible to detect deficiencies and to estimate the amount of expenditures required to meet the demand for educational installations in a given region or country.

Inventory information is direct input for preparing school maps and determining the installed capacity and, indirectly, makes it possible to calculate deficits, determine cost and investment priorities and prepare work programmes.

The Universe covered by an inventory may be total or partial. It is sometimes sufficient to obtain information through a reliable sample, and this reduces efforts and costs.



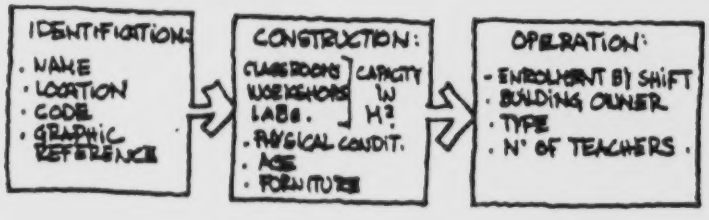
. OBJECTNE : DETAILED KNOWLEDGE OF THE SCHOOL NETWORK.

. THIS IMPLIES:

+ BUILDING DATA
+ ENROLMENT DATA
+ TEACHERS DATA

= INVENTORY OF EDUCATIONAL FACILITIES

. MINIMUM INFORMATION:



From an interpretation of the information obtained, conclusions can be reached for efficiency in the use of each school building, that is, underuse or overuse of facilities, which are basic data that would provide guidelines for establishing:

- *new facilities;*
- *the number and location of buildings that, because of their unstable construction, unhealthy conditions or unsuitableness for teaching activities, should be replaced;*
- *possibilities for expansion or changes in the schools;*
- *repair and maintenance requirements.*

The inventory process may be divided into three parts:

- preparing questionnaire forms,
- gathering information, and
- processing data.

The questionnaire form is the tool that makes it possible to gather basic information regarding each building and its content is closely linked to the objectives set forth, including those listed below:

a) Determine the location of school buildings by region or zone.

b) Determine the student capacity of the educational system.

c) Determine the physical conditions of the buildings.

The questionnaires should be designed so as to be easily understood, leave no room for doubt and make it possible to process the information with precision. The information required may include the subjects listed in Appendix I.

The depth and degree of sophistication and precision in the information should be carefully determined and the obtaining of useless data which would increase processing costs and efforts, should be avoided.

In collecting data, it is advisable to have trained staff and, if possible, to include student participants, preferably those studying engineering, architecture or technical fields, thereby reducing the risk of obtaining data that is incomplete or distorted by the users of the buildings to be analyzed.

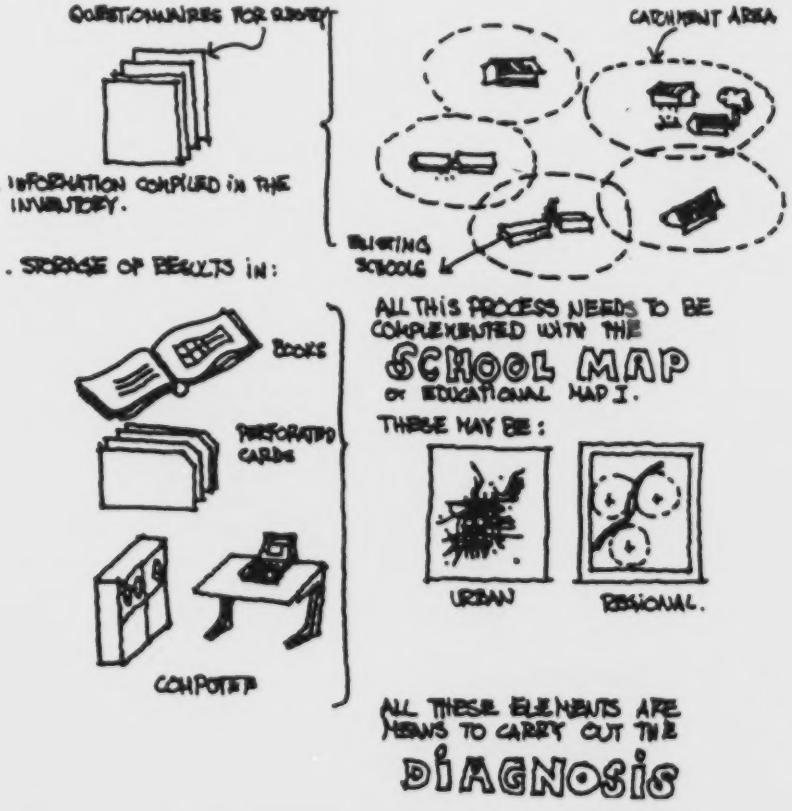
For this activity, the following factors should be borne in mind:

- Quantification of available manpower, material and financial resources.
- Definition of the scope and limitations of the inventory in regard to educational levels, geographic coverage, type of buildings, etc.
- Establishment of the type of study to be conducted, for either multiple or specialized use, as, for example: only for the detection of maintenance needs.
- Design of charts of the results and cross-referenced information required for such charts, as well as additional levels of information.
- Determination of the type of information processing to be used, either manual or automatic.
- Design of the questionnaire or form for the survey and instructions for filling it out.
- Typology of staff responsible for the survey to ensure reliability of information and to define training programmes.
- Design of procedures to verify information collected (quality control) and to update periodically the data gathered.

- Design of mechanisms for the survey and establishment of the logistic support required.
- Analysis and definition of information.
- Statistical processing.
- Preparation of charts and final concentrated information.
- Updating and maintenance of information.

Data processing begins by organizing the information gathered and by making an evaluation to ensure its validity; the following step depends on the processing systems used, although it is advisable at this time to focus on the inventory process as a system because of the developments that have recently taken place in electronic mechanisms for processing information.

The main characteristics that lead to a systematic approach to the inventory are discussed below.



A systematic approach to inventory.

What is generically known as information systems implies a whole series of work methodologies and tools designed to make sufficient, reliable and timely information available for decision-making.

Information systems could be defined as the set of processes for gathering, selecting, processing and updating information in order to provide elements that make it possible to optimize decision-making.

As may be seen from the definition above, the use of highly sophisticated electronic mechanisms is not essential. The definition is simply intended to show that they are processes with a good dose of rationality in which a methodology should be used that will ensure the orderly handling of data.

On the other hand, the tremendous boom of computers in recent years, the enormous variety of possibilities in the market and the very broad range of costs make their possible use attractive, particularly when dealing with large quantities of information and complicated processing of such data.

What should not be lost sight of is that, at a given time, the problem and its characteristics should be the elements that prompt seeking a computerized solution and not vice versa, when the fictitious need for using a computer defines the characteristics for solving the problem.

Thus, the so-called systematic approach to solving a specific problem may be useful and consists of the steps listed below:

- *Establish objectives.*
- *Determine the activity scope and limitations of the system.*
- *Define the basic composition of the system (available inputs, internal interactions, products required and feedback).*
- *Establish operational alternatives for the system.*
- *Select the final option so that its final design may be prepared.*

selecting the most advisable options and implementing the operation.

Within the entire process, efforts should be made to balance limitations, generally caused at the technological level of the environment where data is obtained due to the shortage of economic resources, on the one hand, and the uselessness of information and its degree of reliability, on the other.

Finally, it should be noted that the school inventory is not an end in itself, nor should it be considered an information system. The inventory is a working tool for subsequent tasks and thus, particulary during the planning and definition stages, it should be carried out within a multidisciplinary environment in which those responsible for subsequent work should express their needs for information and its processing, in order to take full advantage of the work carried out to reconcile and meet the needs detected.

D. EDUCATIONAL MAP I

The educational map, also referred to as the SCHOOL MAP, ORGANIZATIONAL PLAN OR MICROPLANNING in different places may, in fact, be understood as an educational microplanning process in which different specialists, local authorities and the community participate. Its purpose is to interpret the information available on the existing educational resources in order to propose a specific plan prepared at the level of each community within national educational policies.

The educational map is part of the educational facilities planning process, within which it serves as an analysis tool, which is not limited to describing and recording the current situation, but also conceives new models that would solve problems foreseen in the future with suitable techniques.

This activity has been developed at two levels in regard to the physical plant: the first level is entitled educational map I and includes the location, condition and use of existing educational facilities; the second level, called educational map II, includes the proposal of plans or programmes for new projects, substitutions, expansions, repairs and maintenance of educational facilities.

Educational map I is prepared over base maps, which include political and administrative divisions of the area, topography, water and road systems, infrastructure, built-up and green areas, etc. The location of educational centres is superimposed on these maps and names, educational level, capacity, enrolment, shifts, construction conditions, legal status and other data, are clearly indicated.

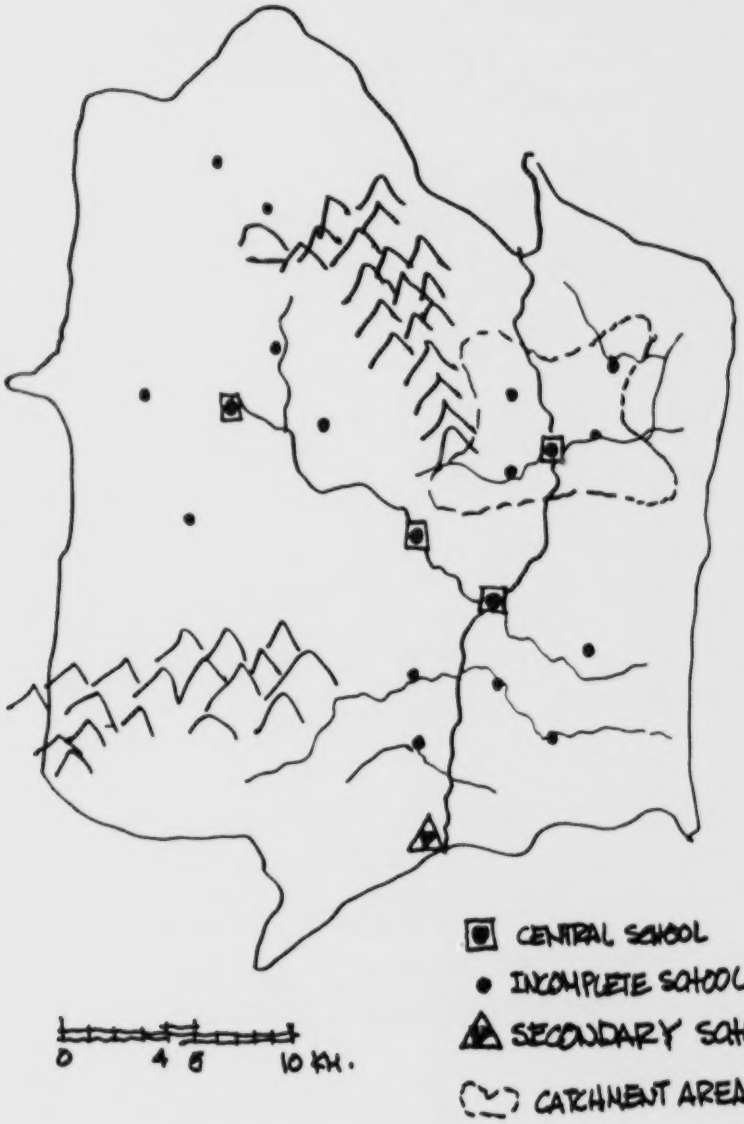
At the same time, other graph documents are required to support the basic maps such as maps of land production and use, population density, migrations, catchment areas and available land, all of which provide more precise and integrated knowledge of the existing situation.

Although the information required is related to micro-levels in which local or zone maps may be used, national, state and municipal maps are also required for reference.

When the information required is simple, it is generally included on the map next to the place or location of each educational centre. When the quantity of data per centre is extensive, it would be recommended to place the information outside the edge of the map with reference to the location, using a suitable set of symbols to facilitate reading.

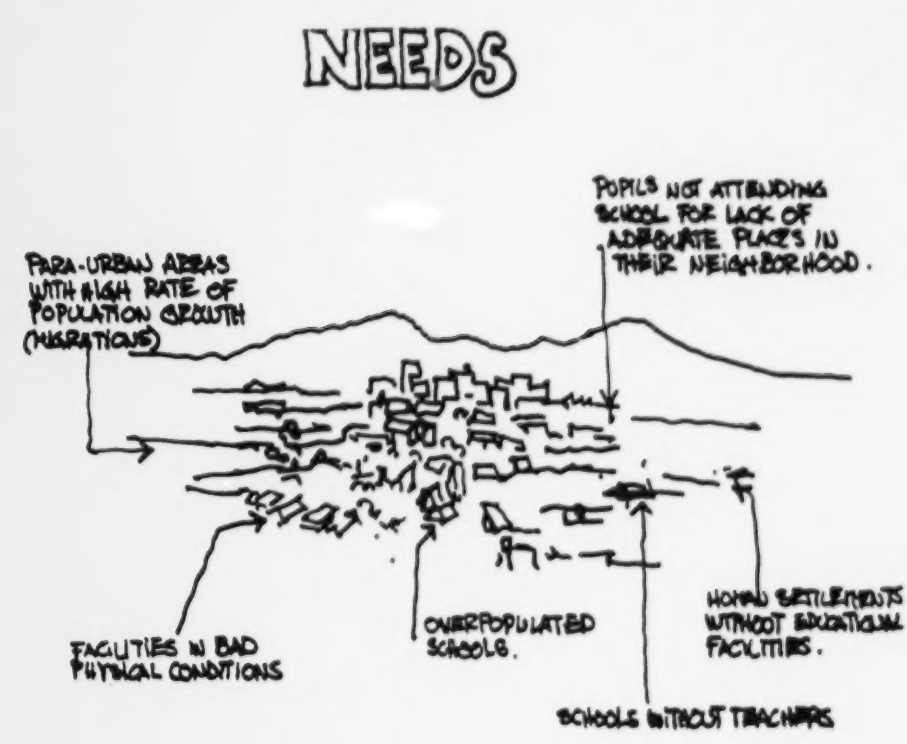
In some cases, more complex charts must be prepared and may be placed on the same page as the map, making reference to the centres.

EDUCATIONAL MAP 1.



E. NEEDS (Demand)

Needs in population terms, are understood as the total population that requires education, composed of the school age population, the handicapped, and those no longer of school age, including adults.


NEEDS
PUPILS NOT ATTENDING SCHOOL FOR LACK OF ADEQUATE PLACES IN THEIR NEIGHBORHOOD.
PARA-URBAN AREAS WITH HIGH RATE OF POPULATION GROWTH (MIGRATIONS)
HUMAN SETTLEMENTS WITHOUT EDUCATIONAL FACILITIES.
OVERPOPULATED SCHOOLS.
FACILITIES IN BAD PHYSICAL CONDITIONS
SCHOOLS WITHOUT TEACHERS
THESE AND OTHER NEEDS AND PROBLEMS IDENTIFIED IN THE INVENTORY AND IN SCHOOLMAP I DETERMINE THE
DEMAND

In this activity, a study is conducted of the needs stemming from the school age population to be attended, in accordance with educational goals. In terms of physical infrastructure what is needed is the total educational facilities required to respond to the needs of that population.

Part of such needs are met with current resources and the rest (deficit) should be solved within a specific period of time, in accordance with the strategies defined in the educational policy.

Actual experience shows that there is a certain percentage of repetition which would be extremely difficult to eliminate entirely. Such students who repeat studies eventually fall outside of the school age group and another percentage of drop-outs form part of the unserved school age population.

Knowledge and control of such factors makes it possible to reduce them and to identify a realistic demand calculated through cohorts formed by grade and by year, bearing in mind the population increase as indicated by census projections.

Such estimates require knowing the population figures broken down by yearly ages. When this information cannot be obtained directly from census sources, it is advisable to calculate it indirectly using methods such as linear regression or Sprague's coefficients.

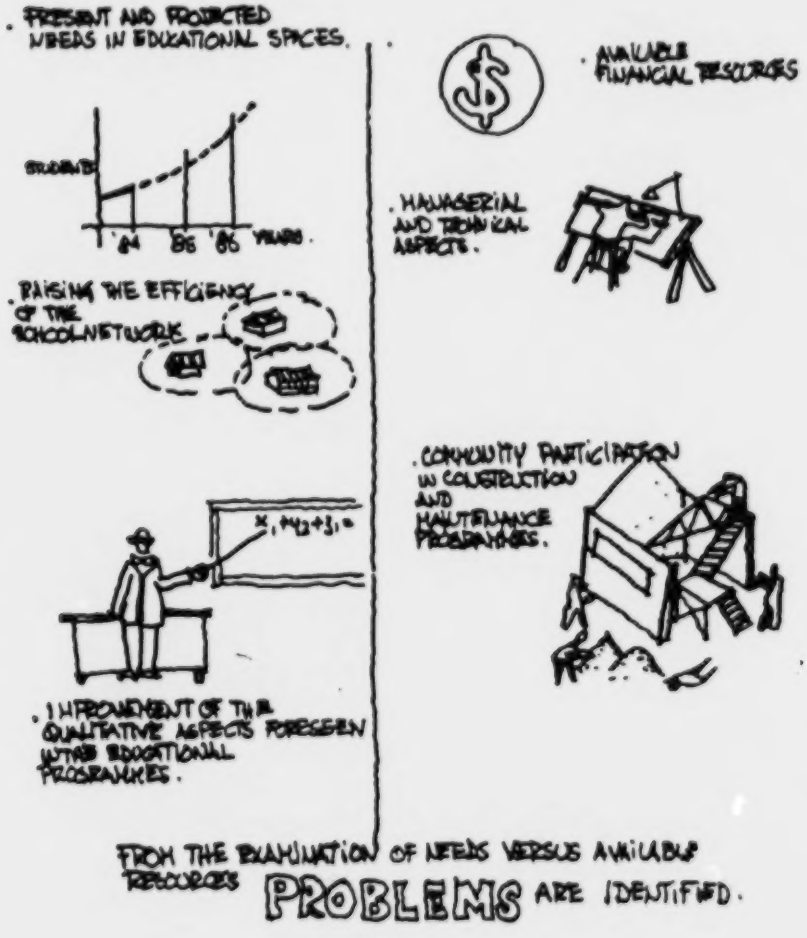
It should be stressed that such information should be obtained, not only at the national level, but at the state, municipal and local level as well, and should be divided according to urban and rural areas and by sex in order to make it useful in microplanning and macroplanning at each of the educational levels and in each speciality.

At micro level, population projections are sometimes distorted by migrations caused by poles of economic development or by the polarization of job opportunities; furthermore, birth and mortality rates usually vary in each locality and this makes it advisable to conduct a specific study of each situation.

Forming cohorts from each location makes it possible to quantify the demand population by age and educational level. Such information, with the use of certain efficiency parameters, number of shifts, etc., can be used to translate the demand into the amount and type of facilities, furniture and equipment required and, consequently, to estimate costs.

F. PROBLEM IDENTIFICATION (Deficit)

By means of the analysis of resources and needs, problems affecting the educational systems may be systematically identified with precision, and through diagnosis, this enables those responsible for education to make decisions regarding the formulation of alternatives for educational policy.


. PRESENT AND PROJECTED NEEDS IN EDUCATIONAL SPACES.
'84
'85
'86
YEARS
. AVAILABLE FINANCIAL RESOURCES
. MANAGERIAL AND TECHNICAL ASPECTS.
. RAISING THE EFFICIENCY OF THE SCHOOL NETWORK
. COMMUNITY PARTICIPATION IN CONSTRUCTION AND MAINTENANCE PROGRAMMES.
. IMPROVEMENT OF THE QUALITATIVE ASPECTS FORESEEN WITHIN EDUCATIONAL PROGRAMMES.
FROM THE EVALUATION OF NEEDS VERSUS AVAILABLE RESOURCES PROBLEMS ARE IDENTIFIED.

The location and type of population that requires education is a basic determining factor identifying problems and defining the physical response to such problems. The population is composed of the school age population, both normal and handicapped, and the population that no longer falls within school age, which may be classified as well-served, poorly-served and unserved by the system.

Both the unserved and the poorly served population should be properly incorporated into the system with: new projects, expansions, substitutions, remodelling and repairing of educational facilities with all the support required to ensure their proper use, that is, with suitable teaching staff, furniture, equipment and installations.

Problems identified in relation to educational facilities could include insufficient facilities, poor location, buildings in bad condition, high construction costs, lack of maintenance, lack of entity responsible for the physical plant (be it the Ministry of Education, the Ministry of Public Works, or an independent body), designs unadapted to the various climates, etc.

Responses are, on the one hand, PREVENTIVE and attempt to build educational facilities that are well designed, constructed and utilized and, on the other, are CORRECTIVE and attemp to improve the existing situation by upgrading the productive use of facilities with better organized school calendars, groups compatible with the capacity of the facilities, more operational shifts, etc., in addition to preparing teaching staff, improving furniture and equipment, so that the facilities are overall in a condition to respond properly to educational needs, and implementing repair, remodelling and substitution projects in order to meet *minimum standards for space, comfort and safety.*

With such activities, the current constructed area can be made suitable for optimally responding with its capacity, although it will not generally meet the entire educational needs, which may require expansions or new projects.

IV

RESEARCH AND DEVELOPMENT

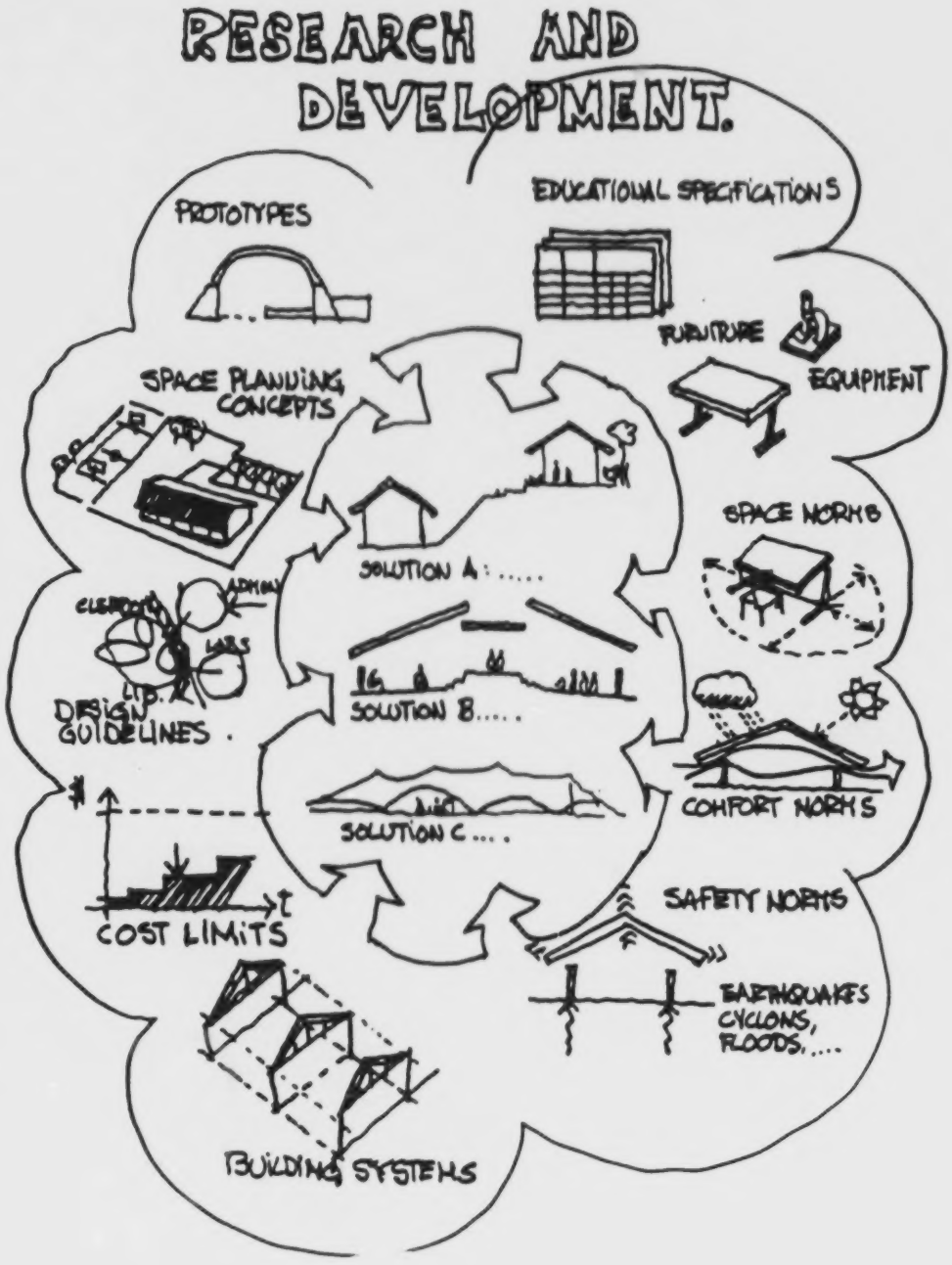
The purpose of the RESEARCH AND DEVELOPMENT CYCLE is to define parameters, norms and prototypes of educational facilities that will serve as a basis for formulating projects, plans and programmes, as well as for programming, designing, implementing and evaluating school buildings.

It is a question of defining educational specifications that should be met by the facilities, the type of furniture and equipment required, the space, comfort and safety standards, the advisable construction system, cost limits that will make it possible to establish estimates for the first stages of the process, conceptualization of the spatial organization of the school buildings and the establishment of design guidelines and facility prototypes to be used in preparing and implementing plans and programmes.

Difficulty in responding comprehensively to educational needs by means of the usual resources sometimes leads to seeking solutions that prove to be of great use, such as mobile educational facilities and the use of radio and television - solutions that should be adapted to specific situations that justify their use, in accordance with their cost effectiveness.

Norms established in the educational facilities planning process are developed through two complementary procedures:

- a) Establishing norms through the functional analysis that determines the conditions an educational facility should meet.
- b) Assessing the actual situation through the study and approval or rejection of facilities to the degree that they do or do not fulfil the objective set forth.


RESEARCH AND DEVELOPMENT.
PROTOTYPES
EDUCATIONAL SPECIFICATIONS
FURNITURE
EQUIPMENT
SPACE PLANNING CONCEPTS
SOLUTION A : .....
SPACE NORMS
SOLUTION B.....
DESIGN GUIDELINES .
SOLUTION C.....
COMFORT NORMS
COST LIMITS
SAFETY NORMS
EARTHQUAKES CYCLONS, FLOODS,....
BUILDING SYSTEMS

Norms for design should be general guidelines of a local or regional nature, as required, and should be indicators of the trends to be followed in planning educational facilities, although their most important use is to serve as a basis for designing educational facility prototypes, which will facilitate taking full advantage of all the benefits offered by the systematization of activities from the design stage up to the stage of implementing projects. This will allow rational working methods to be incorporated in order to co-ordinate factors of quality, quantity, cost and time.

A. EDUCATIONAL SPECIFICATIONS

The link between educational planning and physical planning should be systematic and continuous. Educational facilities planners need the collaboration of educators who in turn, need the experience of architects and engineers for physical environmental matters.

The development of school construction does not only mean an increase in the number of buildings, but also the most suitable or easily adaptable design solutions to meet the changing requirements in education. The building or the physical solutions that are adopted must be sufficiently flexible to allow for adaptation and expansion resulting from changes proposed.

Educational specifications could be defined as the systematic and detailed description of the requirements of the educational system. Such information serves as a basis for defining the type of centre and the number and type of facilities that provide the most appropriate response.

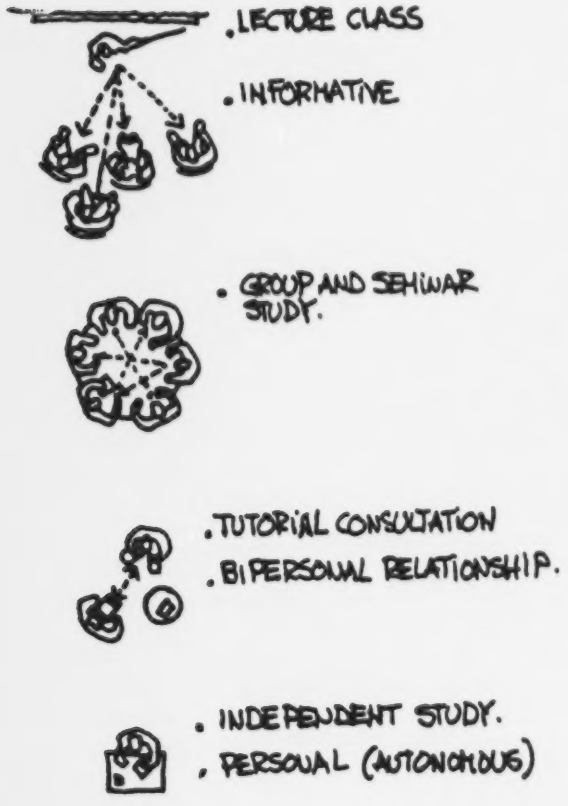
The definition of the type of educational centre requires specifications on factors such as:

a) Type and level of education, student age group, duration of studies of each type and at each level.

b) Curricula and activity schedule for each course by type, level and grade, and use factors.

c) Enrolment by type and level of education.

d) Possible future changes in the educational system.



Educational facilities, moreover, respond to the most precise specifications in the activities that form the objectives of each course. Such activities should be analyzed in detail and may be of several types, such as:

Curricular:	the direct teaching/learning activity, in accordance with the curricula and study programmes.
Research:	study activities, which benefit the teaching/learning quality of the institution and may be useful outside the institution.
Extension:	activities that link the educational institution culturally and socially with the outside community.
Supplementary:	activities that meet basic needs in the educational community such as housing, food, recreation and transport.
Administrative:	activities for directing and controlling the development of other activities.
Service:	basic support for administrative activities such as cleaning, maintenance and supply.

The dynamics proposed in each activity should also be known:

- *informative activities, lecture class, seminar practice, free study, advisory sessions and other activities;*
- *the number and type of people who participate, the physical distribution of the groups while the activity is being conducted; and*
- *the degree of mobility of the participants in the activity.*

Other factors, such as area per student comfort and safety standards, type and quality of furniture, equipment, teaching aids and installations, will be analyzed further on in the document. All these points should also be analyzed in respect of each educational activity.

All this information should be compiled on sheets or forms according to courses in order to facilitate dialogue between the educational planner and the physical planner. (see suggested forms below).

SUBJECT	ACTIVITY	REQUIREMENTS								
		USERS		SPACES			FURNIT-URE	EQUIP-MENT	INSTAL-LATIONS	OTHER

. SPACE TYPOLOGY.

SPACE	ACTIVITIES	CHARACTERISTICS					
		USERS	FURNIT.	EQUIP.	INSTAL.	OTHER	OBSERV.
CLASSROOM	A.. B.. C...	25					
LABS.							

. QUANTIFICATION OF SPACES.

# OF GROUPS / GRADE / SUBJECT				CLASSROOM	LABS	WORKSHOP	MUSIC ROOM	LIBRARY	SEMINAR	...	...	TOTAL TEACHING LOAD.
MATHEMAT.				x								
NUMBER OF SPACES →												
USE FACTOR →												

Subsequently, such information will be incorporated into the architectural brief as a list of specifications that should be met by each educational facility.

Educational facilities, furthemore, can meet the most precise specifications in the activities that make up the objectives of each course and such activities should thus be analyzed in detail.

B. FURNITURE AND EQUIPMENT

i) FURNITURE

Furniture is the set of elements that are supplementary to a school building and serve as a link with the user, making it possible for him to carry out his activities within the facilities. Work furniture (tables, chairs and benches) serves the user directly, and depends on his position and movements; its efficiency is measured in terms of comfort. Such furniture may be distinguished from storage furniture, which is sometimes fixed and built into the construction and is intended to protect and make teaching aids and materials available. It thus serves the user indirectly and its efficiency is measured in terms of functional suitability.

Providing schools with classroom furniture that is suitable for each level and each type of activity is a need that is directly related to the physical and intellectual well-being of the learner and affects his performance.

On the basis of the concept that classroom furniture is fundamental for conducting teaching activities in each of the educational facilities, such furniture should be functional, comfortable, economical, aesthetically pleasing and of a type that can be manufactured locally.

a) Programming

Programming is the result of an analysis that determines the quantity and type of furniture for each activity and the size of the group of users.

Programming is presented as a list of types of furniture with specifications that include such things as quantity, basic dimensions, material and finishes required.

Specifications are the result of studies of the anatomical and dynamic characteristics of the potential users of the furniture. Such studies determine the measurements that are recommended for each type of furniture after analyzing representative groups of the school age population through specific measurements and positions.

In some cases the user's size is related to a number of measurements linked to the activity such as table height, seat level, chalkboard height and shelf height. Percentage charts by grade and size category are then prepared.

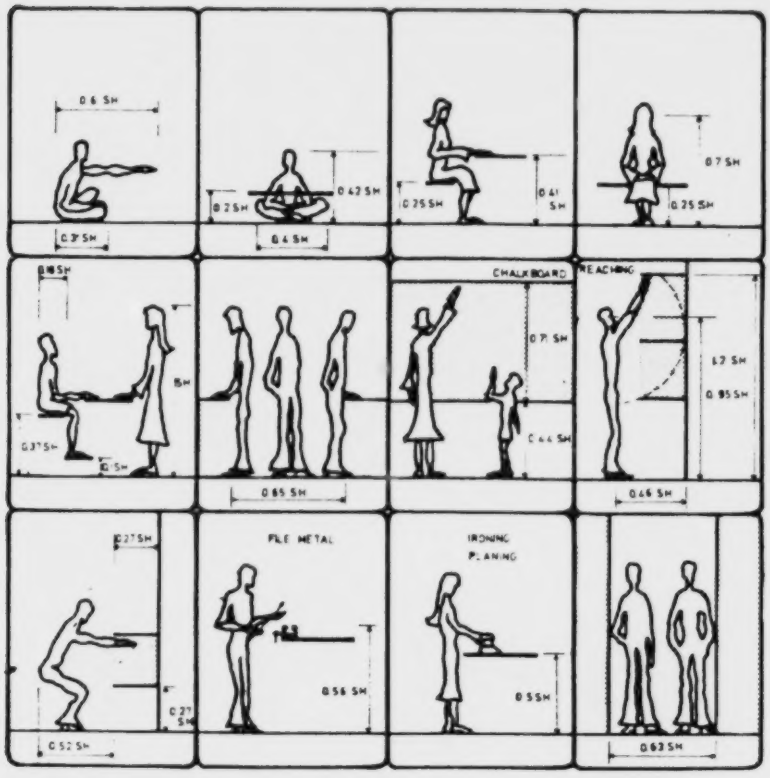
In other more detailed studies, measurements are analyzed directly in relation to other dimensions apart from size, in which the user is measured in accordance with the following list:

1. Weight
2. Maximum height reached with the arm raised
3. Size or height
4. Height of the eyes from the floor (standing)
5. Height of the elbow from the floor (forearm bent).
6. Height of the wristline from the floor
7. Height of the dactylion from the floor
8. Arm length
9. Elbow-dactylion length
10. Shoulder width
11. Distance between armpits
12. Width of hips
13. Distance between elbows (hand folded)
14. Height of eyes from the floor (seated)
15. Height of the lower corner of the shoulder blade (seated)
16. Height of the elbow from the floor (seated)

17. Height of the knee from the floor (seated)
18. Height of the knee from the floor (legs crossed, seated)
19. Height of the gluteal plane of contact with the chair from the floor (seated)
20. Popliteal distance between the sacrum and the knee (seated)
21. Distance between the sacrum and the popliteal fossa (seated)

ANTHROPOMETRICS

MEASUREMENTS RELATED TO STANDARD HEIGHT : H.



SOURCE : EDUCATIONAL BUILDING DIGEST.
UNESCO REGIONAL OFFICE FOR EDUCATION IN ASIA AND THE PACIFIC. BANGKOK. 1973.

Such measurements make it possible to prepare a better adapted typology of furniture that responds more adequately to the type of user in a given country or region.

b) Design

Design should be adjusted to what is programmed, bearing in mind the situation and possibilities of local industry and the availability of materials and manpower. Furthemore, dimensions and characteristics should reflect those of the user and thereby facilitate his movements. Work furniture (tables, chairs, benches, etc.)should be strong and easily moveable in the event of storage or transfer. Provisions should be made so that it may be used for different purposes for short periods of time.

c) Manufacturing and storage

First and foremost, the possibility of manufacturing at least part of the furniture in the workshops of existing educational centres should be explored so that *learning could take place through production.*

Before acquiring furniture manufactured outside the country, national production capacity should be analyzed to see if the delivery schedules, quality and costs are compatible with those planned.

At the manufacturing stage, the person responsible must seek balance among rate of producation, availability and delivery of raw materials, availability of labour, storage capacity for both raw material and for items manufactured, etc.

All these concepts are interrelated and delays caused by any one of them could produce a need for greater storage capacity, slow down deliveries and increase the cost of the product and bring about inconveniences.

When the demand for goods is high, this usually brings about a shortage of storage space, thus careful planning for a sufficiently large storage area must be made so as to avoid having to leave goods outside, where they will deteriorate, to prevent delays in deliveries and in the consequent installation of the goods.

d) Distribution

Distribution should be conceived as a dynamic and precise system to co-ordinate production and delivery. If production is continuous and homogeneous, distribution may be channelled through a government agency; if not, distribution may be carried out by hiring specialized companies.

The type, capacity and promptness of transport to be used should be taken into account, in addition to the location of education centres and their access to communication networks (highways, roads, railways and rivers).

e) Maintenance

The life span of classroom furniture depends on its type, quality and maintenance.

Proper maintenance prolongs the life span of the furniture and avoids its premature replacement and the cost this would involve. Depending on each situation, plans may be made for:

1) a state supported central maintenance system,

2) a decentralized system with teams responsible for maintaining classroom furniture in the state or zone,

3) making the community and users themselves responsible for the maintenance, or

4) hiring private firms to do this.

Community and user participation in maintenance is highly advisable, since it promotes more careful and responsible use. Such participation is more easily attained at the first educational levels, since parents are naturally more interested in problems at educational centres at that time.

ii) Equipment

Equipment may be defined as the set of elements through which knowledge is transmitted and it is, consequently, eminently instrumental.

On the one hand, some equipment serves as an end in itself, such as a film projector that is studied to learn how it works, and this equipment is also classified as a teaching aid. But equipment may also operate indirectly by making experience possible, as in the case of the same projector when it is used to project a film. In this case, the equipment is functioning more closely to what we usually refer to as installations (transformers, air compressors, etc.).

It is not easy to distinguish the difference between teaching aids and equipment, since there are cases when they are both. Nevertheless, most elements that serve to transfer knowledge more or less directly, including chalkboards, maps, rulers, compasses, projectors and microscopes, are generally placed on the equipment lists.

Such lists should respond to the needs of the educational facilities planning process at each of the stages described below, including list preparation, acquisition procedures, manufacture, delivery and distribution and maintenance:

a) List preparation

The preparation of lists provides detailed specifications regarding the type and quantity of equipment required at each educational level.

Generally, lists are organized on the basis of codes that are prepared to facilitate the use of the material and indicate, for example, the type of laboratory and education centre. The item is then defined and quantity, dimensions and characteristics are specified.

The preparation of lists is a demanding task and specialized staff with experience and knowledge of what is produced in each item, its cost and, particularly, its suitability in relation to the actual situation in each country are required.

At this stage, it is advisable to make a thorough analysis of the possibility of using local resources in the production of equipment and only resorting to more sophisticated resources when these are clearly justified for educational purposes.

In some instances industry or specialized national or international firms may be requested to submit equipment list proposals to meet educational specifications, which can result in more coherent offers of supply at lower costs than when a specific list prepared by a specialist must be complied with.

b) Acquisition procedures

When it is necessary to resort to acquiring equipment manufactured outside the country, it is advisable to avoid excessive diversification in brands and to make certain that there will be a stock of parts later on, that maintenance is simple, and that the equipment will not become obsolete in a short period of time.

Awarding a purchase contract is the result of the patient analysis of each item and of each set of items in order to select the most advisable, which is not necessarily the item of lowest cost.

c) Manufacture, delivery and distribution

When materials are manufactured locally, there should be clear specifications and provisions made for the machinery space, and staff required for its production.

When industry or specialized firms are contracted, the time and place of delivery should be determined and provisions should be made for proper storage and control.

The concepts mentioned for the distribution of furniture may also be applied to the distribution of equipment.

d) Maintenance

It is important to ensure that the educational facilities provide the connections required for the proper operation of the equipment and that the users are trained and familiar with its operation in order to preserve it. Spare parts should be readily available so that they may be used without fear of any shortages.

Storage space to preserve the equipment from deterioration should be available. in some cases, it will be necessary to make special provisions, specially to control humidity and dust in some areas.

All these concepts should be kept in mind, in addition to the requirements stemming from educational activities, which indicate the type of equipment needed at each education centre.

C. SPACE NORMS

In general terms, educational space norms are quantitative and indicate the area needed to carry out an activity properly within an educational space or the total activities in a school for a given number of students.

Norms are expressed as net area per student (without including projected wall area) and vary in accordance with different factors such as educational level and type of teaching, location climate, and resources. Implied within the expression « area per student » is the spatial use of equipment, furniture, teaching aids, material and other means required by an educational programme within an appropriate and economical environment.

A space norm may be prepared through two procedures, which generally complement each other:

a) Functional analysis procedure: An analysis of the educational requirements that are involved in determining space, is made of the following:

i. Participants: type, number, behaviour.

ii. Furniture and equipment: type, quantity, net areas occupied and influence areas.

iii. Installations: electric, sanitary, water, gas, etc.

iv) Physical comfort: climate, environment, acoustic, visual.

The surrounding limits of areas are then studied by sets of similar activities which gives the average areas per student required for a set of activities; thus, by going from the most specific to the most general; area standards are defined by type of space and education centre.

b) Empirical procedure: This procedure consists of analyzing the existing similar or comparable educational facilities in the country and by assessing the operations. This may be supplemented with the analysis of information available on similar cases gathered in other countries, which ultimately serves as a reference for the results of the functional analysis.

Space norms should be flexible and indicative; they should take into account both strictly speaking educational activities and activities related to culture, leisure, social and community recreation.

A careful analysis of the area per student helps to optimize investments, since the cost per student is simply the cost per unit area times the space standard. The closer the relation between area and user, the more productive the investment will be in attaining the teaching objectives at the lowest cost.

D. COMFORT NORMS

Comfort or environmental well-being in educational facilities refers to acceptable or suitable lighting, heat, ventilation, acoustics, psychological and other conditions that should be present in an educational facility so that educational activities may be carried out in the most appropriate manner.

Thus, as an abstraction, comfort may be classified into three basic divisions: thermal, visual and hearing, which have different degrees or ranges of tolerance within which they vary.

The concept of using a facility to conduct an activity efficiently implies that the facility be adapted to, or adapt, the natural environment, inside or outside, to limit the environmental variations to a tolerable range that will provide the user with comfort.

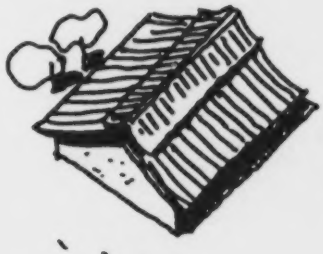
In accordance with the classification given, the following possibilities for establishing comfort criteria may be considered:

i. The THERMAL ADAPTATION of a school building is the sound use of the physical characteristics of the material used in its construction: area, size, form and location of openings, construction procedures, mechanical devices and others, in order to achieve acceptable thermal balance or thermal comfort for most of the users in their normal activities most of the time. The sensation of thermal comfort is related to the degree of humidity and air purity, which may be controlled in extreme cases. Air also affects thermal comfort and it is thus advisable to have barriers of trees to protect from prevailing winds.

Some examples of how to improve thermal comfort in tropical climates are: the use of thicker walls and insulating material (earth, ceramics), the construction of eaves to prevent direct sunlight from entering, outer roof and wall areas that reflect light because of their light and bright colours, the orientation of facilities so that the lighting comes from the north and south sides to avoid facing the sun when it is low in the east and west.

COMFORT NORMS.

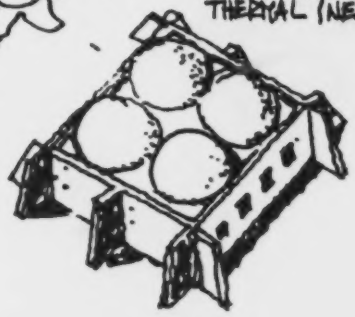
.THERMAL COMFORT



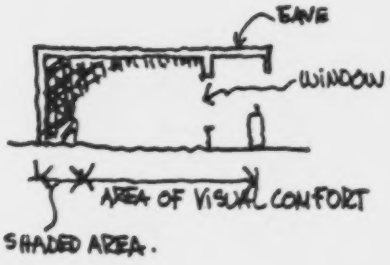
HEAT CONVECTION AND CROSS VENTILATION

PORCHES, HIGH ROOFS CROSS VENTILATION

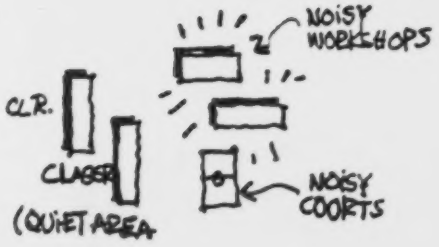
DOMES AND THICK WALLS WITH HIGH THERMAL INERTIA.



.LIGHTING COMFORT



.ACOUSTIC COMFORT



ii. LIGHTING ADAPTATION is the control of natural or artificial lighting and the colour of the environment in order to provide the greatest number of users visual comfort in carrying out their activities most of the time.

Natural visual comfort may be improved with a well-proportioned lighting area that prevents undesirable reflections, with eaves that prevent sunlight from shining directly on work tables, with the use of opaque or semi-opaque surfaces and soft colours and with the location of suitable trees where they may help control natural light. The degree of lighting may be expressed in luxes, lumens or daylight factors.

Artificial visual comfort requires a study into the location of light bulbs. Such bulbs should be designed to provide a suitable amount of light on work surfaces and should avoid glare or excessive lighting that is not required.

ii ACOUSTICS ADAPTATION is using the characteristics of the materials of the walls, roofs and furniture in a facility and the form of the facility in order to provide noise control, both inside and outside, sufficient to enable most users to carry out most of their activities with hearing comfort.

Acoustic insulation may be improved between educational facilities with a double wall with an air chamber in the middle. Outside, it is advisable to separate noisy areas from quiet ones using clusters or groups of plants as buffers.

Some large facilities may require special acoustic studies to prevent reverberations, echoes, dampening of sound and other problems that limit communication among users.

The preparation of comfort norms requires the obtaining and the analyzing of information on locations, such as temperature and relative humidity (maximum, minimum and average), prevailing winds, rainfall, solar radiation, etc. Such comfort norms serve as a basis for programming and designing education centres.

E SAFETY NORMS

While space and comfort norms are determined on the basis of the everyday use of educational facilities, safety norms are conditions that should be met in preparation for disasters that may occur unexpectedly as a result of natural phenomena such as earthquakes, floods or cyclones. In addition to causing tremendous direct damage, such natural phenomena usually cause secondary effects such as fires or collective panic, which may cause even more damage than the natural phenomena themselves.

The most familiar natural phenomena against which protection is needed, are:

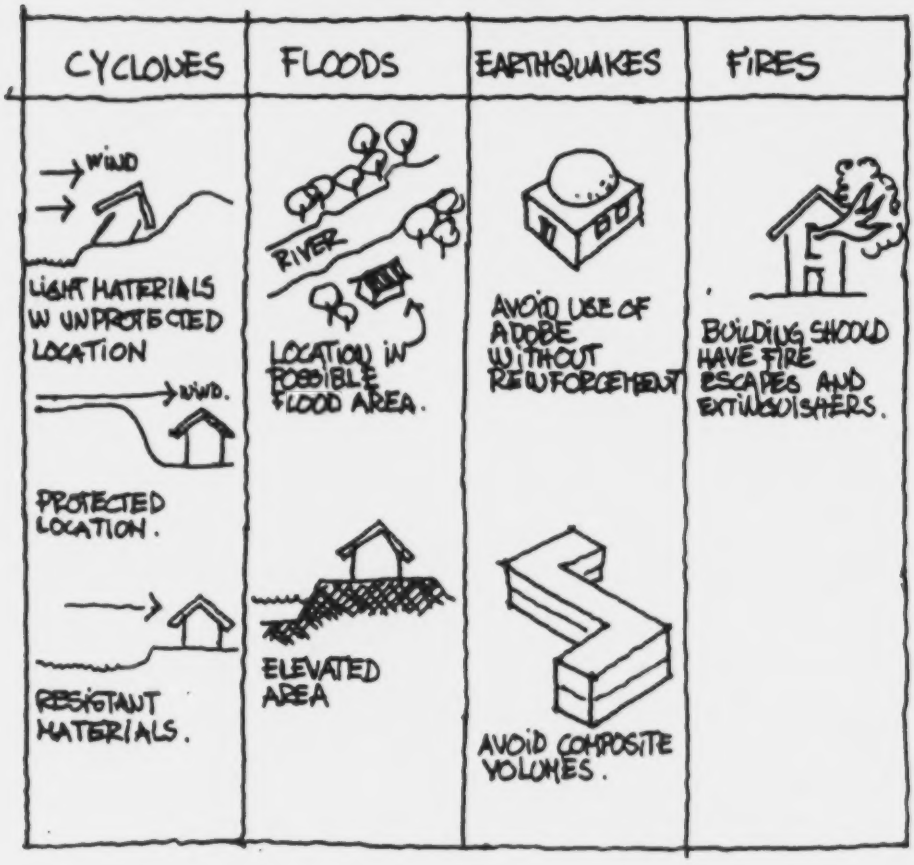
- Flooding rivers caused by rain, melting snow or breaks in dams.
- Tsunanis and coastal floods caused by seismic activity and tropical cyclones respectively.
- Strong winds caused by tropical cyclones, typhoons, hurricanes or tornadoes.
- Earthquakes of tectonic or volcanic origin.
- Landslides, rockslides and snowslides.
- Fires and conflagrations.
- Volcanic eruptions.
- Droughts.

Most of these phenomena cannot be prevented, although precautions may be taken for some of them to minimize their effects.

Their effects on buildings stem from subjecting structures to abnormally intense loads caused by horizontal and upsweeping winds, by the pressure exerted by water and hydrodynamic forces in the case of floods and by vibration forces caused by earthquakes. These effects may suddenly destroy a building completely and take many human lives in doing so. Thus, special attention should be given to reducing the consequences of such phenomena to the minimum during the architectural and structural design stages, as well as during the construction of buildings.

SAFETY NORMS

PREPARATION SHOULD BE BASED ON CAREFUL STUDIES PRIOR TO THE FORMULATION OF DESIGNS.



Countries in regions prone to such phenomena should prepare codes that include appropriate safety standards and should define guidelines for structural calculations, types of material to be used and assembly techniques, in addition to guidelines for the orientation and siting of buildings, and so forth.

It is not always necessary to use more costly construction materials to guarantee resistence against possible disasters, nor to use the construction methods of industrialized countries. In most instances, materials are underused because of lack of knowledge regarding their potential, and more rational use will allow suitable resistence levels to be reached.

It should be borne in mind that an education centre may serve as shelter in an emergency and the flexibility required for doing so should be included in plans for such centres.

F. CONSTRUCTION SYSTEMS

A construction system is understood as the set of interrelated parts that are use to construct a building or set of buildings.

A systematic construction approach makes it possible to choose the alternative for each component which best meets the general objectives, while bearing in mind the effects that the alternatives would have on other components. Keeping such relationships in mind, the partial optimization of each of the elements of the system may then be considered and complex systems may be approached in a logical and controlled manner.

A systematic approach makes it possible to optimize the relation between quantity, quality, cost and time in the implementation of a project.

Such an approach is valid regardless of the degree of industrialization reached by the country or available in a given region. It may be applied both to earth technology and ecosystems (the use of solar, wind, water or biogas energy), as well as to prefabricated structures. However, the greater the degree of industrialization, the more necessary it becomes to have a systematic approach in order to achieve the greatest benefits.

Depending on the degree of complexity, a construction system may be analyzed by:

a) Material: simple or slightly processed, but not final materials; basic substances such as clay, sand, gravel, cement and wood.

b) Elements: the simplest parts of a construction system, formed by groups of processed materials such as bricks, concrete blocks and tiles. The combination of several elements constitute a component.

c) Component: a group of elements that jointly play a well-defined role or function. They are generally classified as:

- foundation
- structure
- floors
- walls
- roofs
- openings
- finishes
- installations
- outside work

d) System: the architectural and construction system made up of elements and modular components that form the supporting structure, together with surrounding or closing subsystems, the combination of which allows for a wide variety in organizing educational facilities and their expansion Supports should take the form of an open system where several closing subsystems may be used in order to adapt to the regional architectural and climatic conditions and local availability.

A construction system is defined by the basic materials used, which may include:

- *reinforced concrete (cast on the site)*
- *reinforced concrete (precast)*
- *steel (prefabricated)*
- *steel (structural forms)*
- *wood*
- *others*

The starting points for carrying out the development of a construction system are the functional dimensions or geometric surroundings of each educational facility.

Defining such dimensions requires careful modular and dimensional co-ordination that will make it possible to optimize the production of elements and components and avoid the waste of material to the maximum. This process implies knowing the availability of materials in the construction industry, since such knowledge serves as a basis for preparing a design grid, which, in turn, is the basis for the structural grid.

Determining the preferable dimensions for educational facilities is clearly based on the availability of structural components that the local construction industry, either produces or could produce.

In the definition of a construction system for implementing an educational facilities construction programme, two alternatives may be set forth:

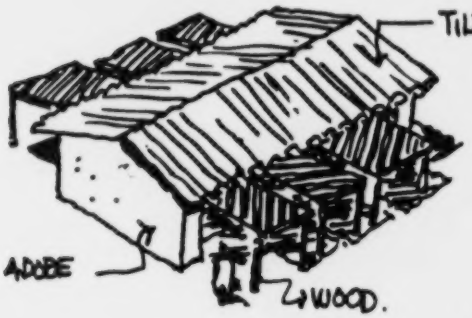
The FIRST ALTERNATIVE is based on using materials, elements and components that are available on the local or national construction market.

The SECOND ALTERNATIVE is based on the search for and development of new construction systems for construction programmes.

The development of new and experimental systems implies establishing detailed work or production and quality specifications for elements and components that industry could feasibly be convinced to produce and that could be used, once their structural design has been completed and their characteristics have been satisfactory in the laboratory.

Although school buildings are constructed in places with extremely varied conditions with regard to climate, topography, culture, etc. for natural reasons, the repetition of designs should be encouraged, since it is advisable to attempt to typify solutions that will facilitate construction and maintenance. From the very outset, it is obvious that absolute TYPIFICATION is impossible, but efforts made to standardize solutions will always be positive. Furthermore, the benefits of experience gained through successive applications of a component or element under different conditions imply a consequent improvement in the design of such components and elements.

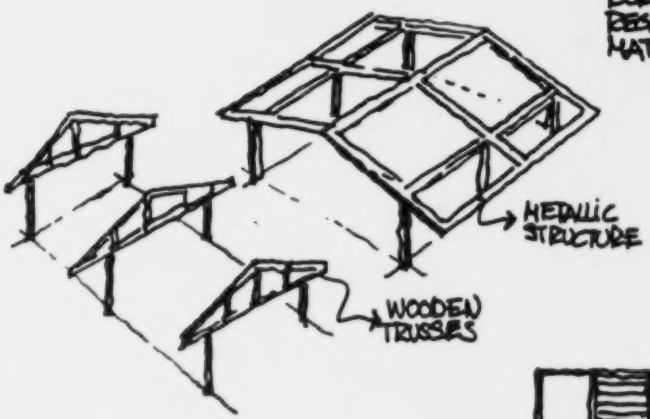
. RURAL AREAS.

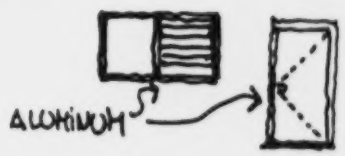


LOCAL MATERIALS
LABOUR INTENSIVE.

. URBAN AREAS.

PREFABRICATED ELEMENTS WITH REGIONAL BUILDING MATERIALS.





G. COST LIMITS

Cost limits may be understood as the base or reference cost that makes it possible immediately to quantify a project, programme or plan drawn up, to an acceptable degree of reliability. It is a work parameter that makes the cost planning of a project possible during the design stage and makes control possible during the construction stage. It provides the educational planner with information for quantifying the amount of investments.

Costs limits may be established at the overall level, as is the case with costs per student or costs per unit area, and also at the specific level, such as costs per unit area for a specific type of facility or cost per building component.

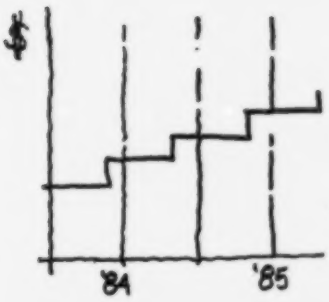
The limits of overall costs are the average of specific costs and are approximate and general. Their validity suffers when an attempt is made to estimate the cost of education centres with different area relations for each type of facility or when building components are given different weight in the budget. In such cases, more precise cost limits must be used, in which cost may be estimated taking the variations mentioned into account.

a) Cost limit per facility unit area

The cost of each type of facility is analyzed separately in order to prepare relative cost charts and equivalent coefficients with base units. The difference is affected by wall density, openings, installations and other factors.

COSTS

RISING CONSTRUCTION COSTS.



FORESEEABLE COST LIMITS PER TYPE OF SPACE:
- . CLASSROOMS
- . LABORATORIES
- . WORKSHOPS
- . ADMINISTRATION
- . ETC.

. FACTORS AFFECTING COSTS

- . INFLATION
- . CHANGES IN CURRICULUM
- . USE FACTORS
- . BUILDING SYSTEMS
- . NUMBER OF SHIFTS
- ....
- ....
- ....

. FACTORS THAT MAY HOLD RISING COST DOWN:

- . BULK PURCHASE
- . PURCHASING IN ADVANCE
- . PROMPTNESS IN AWARDING CONTRACTS.
- . STRICT COST ACCOUNTING.
- . COMMUNITY PARTICIPATION
- ....
- ....
- ....

****

An example of the type of chart that might result is shown below:

****

Type of facility	*Coefficient*
General classrooms	*0.92*
Special classrooms	*1.00*
Laboratory	*0.98*
Sanitary services	*2.02*
General services	*0.99*
Library	*0.98*
Circulation areas	*0.86*
Administrative spaces	*1.13*

A reference cost per unit area - in this case applicable to «special classrooms» - is needed and the areas for each facility in the projet also need to be known.

With such data, the total cost may be determined by adding the product of the reference unit cost times the chart coefficient and the product of the reference unit cost times the area of each facility.

b) Cost limit per building component.

In this case, the cost of each building component is analyzed separately and relative cost charts are prepared, in addition to percentages over total cost.

Component	Percentage
Preliminary Works	1 %
Foundations	8 %
Structure	8 %
Doors and windows	2 %
Roofs and drains	15 %
Floors and subfloors	10 %
Masonry Blockwork	5 %
Finishes	15 %
Glazing	3 %
Chalkboards and display surfaces	2 %
Electrical installations	2 %
Transport and signs	5 %
External works	4 %
Contingencies (unforeseen, administrative and benefit costs)	20 %
TOTAL	100 %

An analysis of cost per component allows comparisons between partial and total building costs to be made, so that judgements on the differences found may be formulated more clearly and problem areas may be pinpointed for action or special attention, to improve their design and/or lower their cost.

H. DESIGN GUIDELINES

The basic purpose of establishing design guidelines for educational facilities is focussed on attaining the following objectives:

a) Determining the organization, operation and characteristics of facilities that are formed by different types of centres for each educational level.

b) Obtaining the greatest degree of efficiency in the facilities in regard to the service they provide.

c) Achieving the greatest economy possible in the facilities and, consequently, in the building costs.

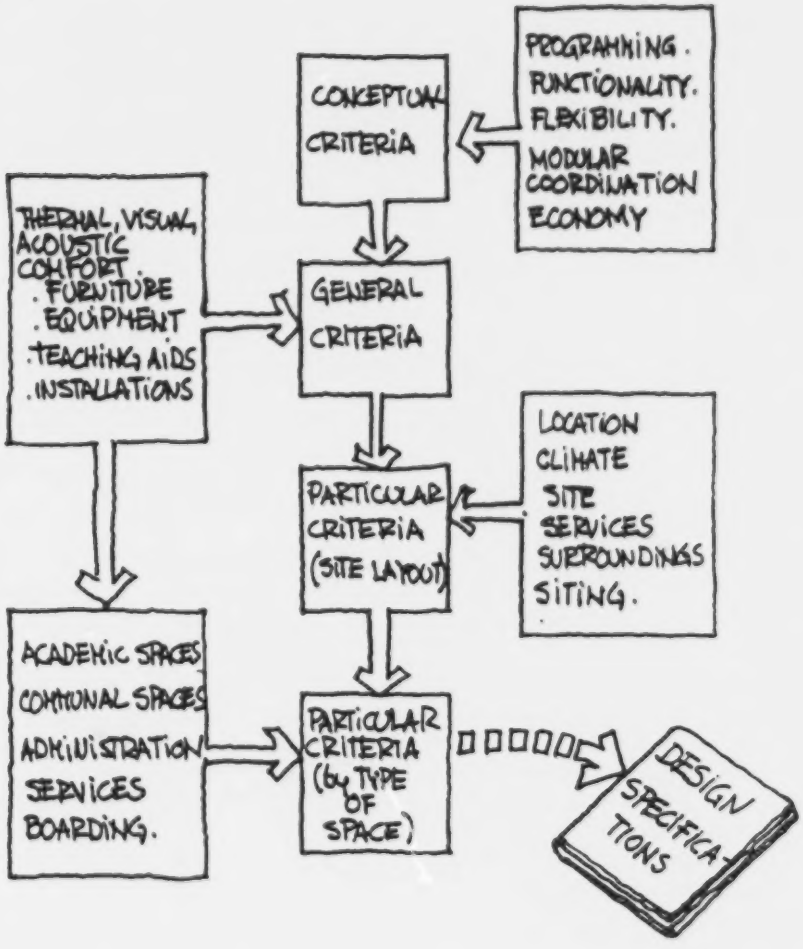
The GUIDELINES developed should be a set of conceptual, formal, dimensional and procedural indicators that facilitate design, evaluation and standard-related activities. Standards are included in three specific areas:

Conceptual criteria basically include the goals of school architecture with principles and techniques such as: programming, functionality, flexibility, utilization, modular co-ordination, construction simplicity and economy.

General criteria include guidelines and conditions related to comfort (thermal, visual and hearing), to equipment (furniture, teaching aids) and to installations (water, electric, sanitary, gas, etc.).

Particular criteria refer to location, climate, land, infrastructure services, environment and site of the education centre. Each type of facility (academic, administrative, supplementary, service, circulation and outside facilities) should be specifically and thoroughly considered.

DESIGN GUIDELINES.



In regard to educational facilities, particular consideration should be given to the following factors: function, capacity, area per student, total area, forms and dimensions, comfort, furniture and equipment, installations, finishes, safety, as well as any particular factor required by some programme or type of special education.

In accordance with their affinity, facilities may be classified by *type of activity or by type of construction*, as required. Classification by activity, as shown below, is the most common:

a) Academic and community facilities.

- General classrooms.
- Special classrooms.
- Laboratories.
- Workshops.
- Multipurpose areas.
- Recreation and sports areas.
- Ressource centres (libraries).
- Dining facilities and cafeterias.
- Auditoriums.

b) Administrative and service facilities.

- Offices.
- Teachers' rooms.
- Sanitary services.
- Storerooms.
- Machine rooms
- Maintenance shops.
- Parking areas.

c) Student boarding facilities.

d) Teacher, caretaker and night watchman residence facilities.

Once activities have been analyzed by courses and their requirements, the types of facilities that would be suitable for them are determined. For example:

- National language, mathematics, civics and vocational guidance may be carried out in a general classroom.
- Geography and history in a social sciences classroom.
- Biology, physics and chemistry in specific or multipurpose laboratories.
- Technological education in workshops (industrial or homemaking arts).
- Art education in music rooms or art shops.
- Foreign language in language laboratories.
- Physical education in sports facilities.

The greater the enrolment, the more specific the physical response to educational activities may be without reducing the utilization of facilities. The general classroom and multipurpose areas should respond flexibly to different activities when enrolment is low.

I. SPATIAL ORGANIZATION CONCEPTS

The spatial organization or structure of the physical plant is a decisive factor that requires particular attention, since most of the concepts that make up school architecture are involved within its context.

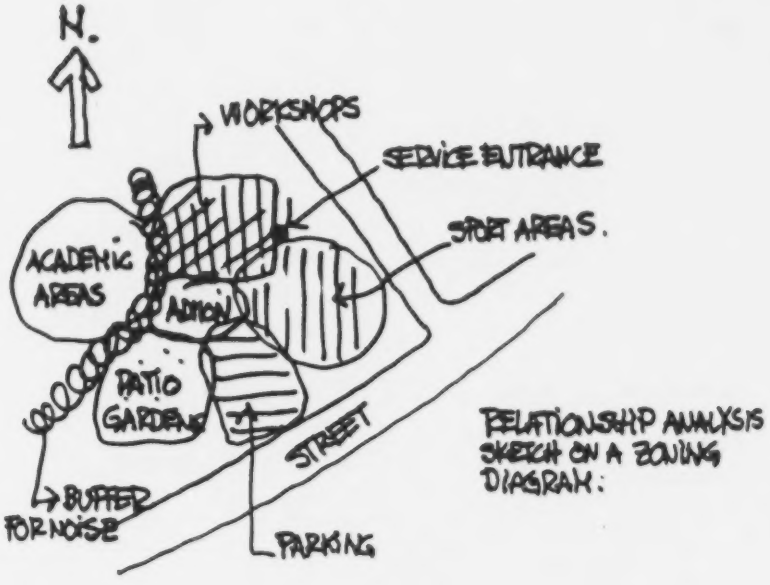
Spatial organization is responsible for making the educational facilities that form a school complex operationally efficient and functional from the standpoint of the interrelationship that should exist between them and of the use of the physical environment's conditions and characteristics. Furthermore, building, administrative and maintenance costs depend, to a great extent, on the solution chosen for the school complex.

The following points should be given special consideration:

a) *Grouping facilities into related study areas.*
b) *Locating concentrated facilities strategically (resource centres, auditoriums).*
c) *Separating quiet areas from noisy areas with plants or by situating them at suitable distances.*
d) *Separating strictly educational areas from community activity areas.*
e) *Exploring possibilities for future expansion.*
f) *Making circulation areas that separate vehicle parking areas from pedestrian areas simple and clear.*
g) *Providing suitable building orientation in relation to winds and the sun.*

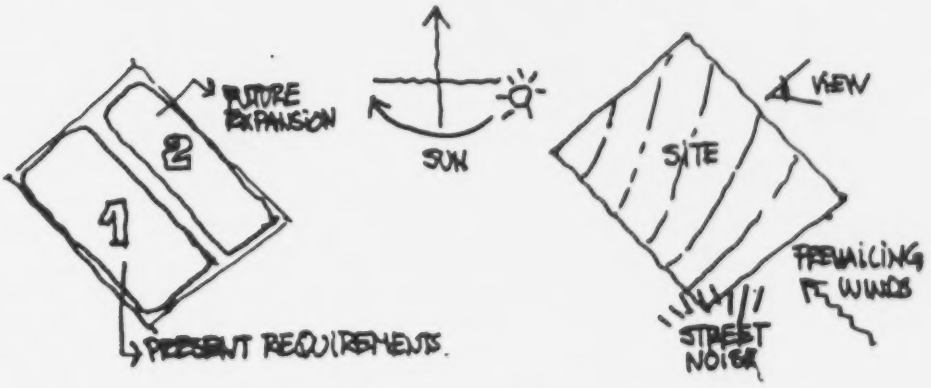
This analysis will make it possible to propose alternatives for grouping facilities and their functional relations, which will serve as a basis for design, since the actual situation of the site where the education centre will be located will be verified, including factors such as topography, subsoil structure, services infrastructure, microclimatology, means of access and environment.

SPATIAL ORGANIZATION CONCEPTS.



RELATIONSHIP ANALYSIS SKETCH ON A ZONING DIAGRAM:

ANALYSIS OF LIMITING SITE CONDITIONS.



J. PROTOTYPES AND THEIR EVALUATION

A prototype of an educational facility is a spatial model that is useful for experimenting with standards, systems, materials, flexibility, teaching methods, etc. and once it has been evaluated and corrected, it serves as a basis for future projects.

The preparation of prototypes is a practical application of the standards established and leads to improving the quality and reducing the cost of school buildings.

It is advisable to set forth an adequate variety of prototypes that could be adapted to the different programming and regional requirements, without limiting the possibilities for architectural creativity.

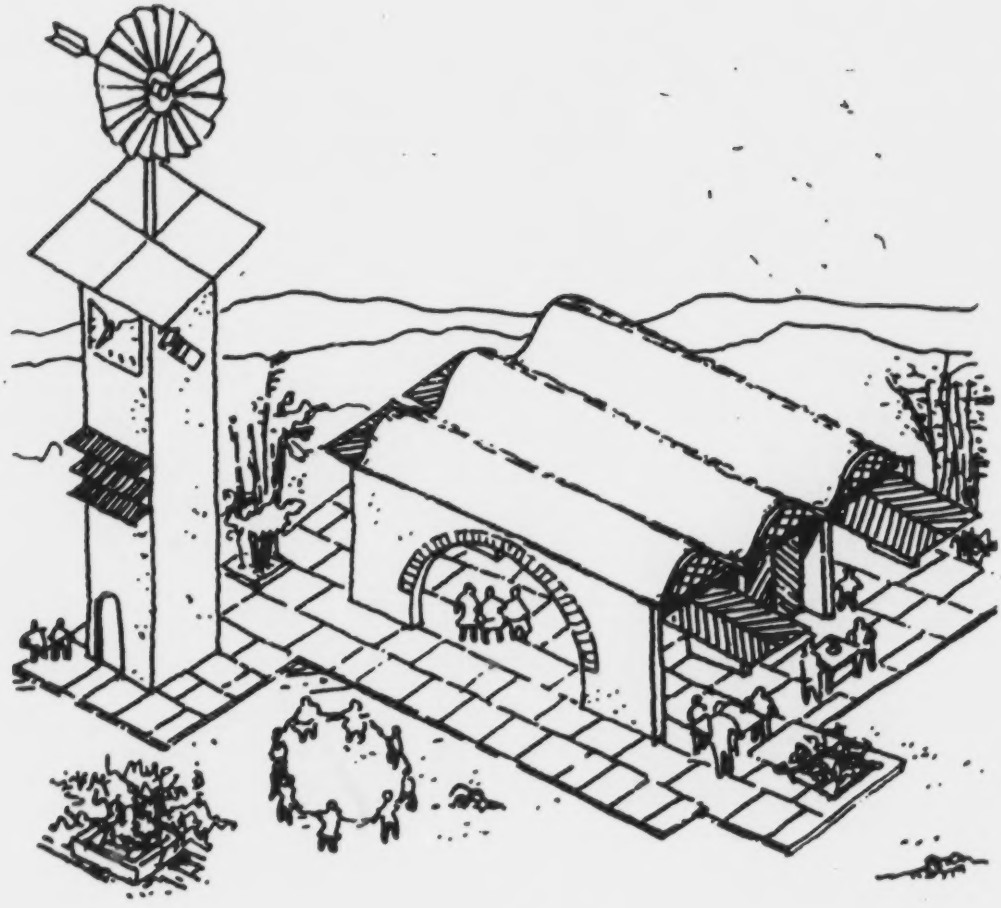
A facility prototype should respond functionally to a number of similar activities that are conducted within it and that will require a specific type and quantity of furniture and equipment.

The preparation of prototypes constitutes a solution prior to specific and final designs and is essential once the sites on which the new education centres will be built, have been decided upon.

Adopting prototypes in a mass programme for school buildings requires economical measures and the rationalization of resources in the design and implementation processes of the projet.

Furthermore, it makes it possible to improve the forecasting and control of costs in the stage directly previous to final designs.

The process for preparing and evaluating prototypes is a simulation of the real process that culminates with the utilization of educational facilities, and thus the most complete model possible should be used in order to avoid, insofar as possible, errors in the final designs.



V

PLANS AND PROGRAMMES

Once problems have been identified and quantified as a result of analysis and diagnosis of the educational situation bearing in mind standards, criteria and specifications and the prototypes for educational facilities have been evaluated, general and regional plans may be prepared as may annual programmes.

Annual programmes indicate the investments foreseen for new projects (completely new and substitutions), expansions, repairs and maintenance of the existing buildings. Such programmes are documented on charts where schools are listed and projects to be carried out are described, together with their priority, cost and time foreseen for implementation.

At the same time, a graph of the programme (educational map II) is prepared and shows the location of each school, the most important data for each school and a description of the work to be done.

The programme should be firmly supported by a suitable administrative structure, should have the resources required in terms of quantity and time and should respond clearly to national school building policies in order to be implemented efficiently.

A. ADMINISTRATION

Generally, structures responsible for programming and administrative control are units located within ministries and may have the following characteristics:

a) Units located in the Ministry of Public Works where a certain number of professionals specialize in school construction. In such cases, the Ministry of Education supplies them with the site and the number of buildings to be constructed and the Office of Public Works provides the design and implements the work.

b) Special units located next to the planning offices of the Ministry of Education. Sometimes the Office of Public Works is requested to proceed with building; on other occasions, there are construction offices in the Ministry of Education itself.

c) Some countries choose to have decentralized units that generally depend on councils composed of representatives of several ministries.

In any of the three cases, there should be an independent budget available that provides the units with an acceptable degree of flexibility in expenditures, particularly when those who participate in the construction are small local firms or communities themselves. In any case, it is important to consider the access and participation of the local educational authorities in the administration of such programmes.

The concept of administration has gained increasing importance as knowledge of systems has progressed in response to situations that are increasingly difficult to confront spontaneously. Educational structure, in particular, is one of the most complex and thus its proper administrative control is both important and notable.

It could be stated that what is administered is necessarily an organized group, whether it is called a company or an institution, and what is sought is to obtain better results through the executives who are responsible.

Administration is a technique and has rules and instruments, such as: delimitation of responsibilities per position or organizational charts in which related functions are clearly shown.

Four stages of administration may be defined:

a) Forecasting, in which possible alternatives are developed using a suitable strategy and tactics, in accordance with objectives that respond to classical questions of what, who, when, how, where and why.

b) Planning, in which the most appropriate alternative is defined and programmes to meet the demands of tasks, time and costs are prepared.

c) Organization, in which an implementation mechanism is defined, that is, functions are limited and defined by level or responsibility, quantity, type of hierarchical levels, type of staff appropriate for each level, etc.

d) Management, which implies co-ordinating the tasks foreseen, so that they are implemented effectively. This requires delegating duties; supervising, controlling and interpreting results that allow tasks to be evaluated in relation to plans and avoiding the reoccurrence of mistakes or flaws.

All the efforts directed towards optimizing the different planning stages are necessary, but not sufficient, if the system is not efficiently managed in accordance with a logical analysis that uses the resources available in the best manner possible.

B. FINANCING

Since education is a direct contribution to social development, its expansion and development are fundamentally the responsibility of the State. Additional resources also come from private funds, as well as from international donor and credit organizations.

The allocation of State funds to various sectors, including education, depends on the priorities or economic policies established by the governmental authorities for the period in question. Since budgets are usually drawn up yearly and plans and programmes cover a longer period of time, it is a question of linking them through budget per programme.

In general, such expenditure budgets are grouped by institution, by expenditure item, by economic item, by functions or by programmes and activities. Classification of expenditures may be combined according to the specific uses and type of analysis desired, establishing different categories and presentations for budgets.

The ratio of public expenditures earmarked for education in relation to the Gross Domestic Product (GDP) (data taken from the 1981 UNESCO Statistics Yearbook) varies by country in percentages that range from 1.2% to 3.0% in Cameroon, Haiti, Paraguay and Greece; between 6.0% and 9.8% in countries such as the USA, the USSR, Congo, Sweden, Canada, Israel, Australia and Cuba.

The ratio of public expenditures earmarked for education in relation to State expenditures varies from 4.0% to 12.0% in countries such as Hungary, Venezuela, Sri Lanka, Haiti and Algeria; and between 17.0% and 32.4% in countries such as the USA, Congo, Cuba, Ecuador, Hong Kong, Switzerland and New Zealand.

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Once the sources of financing, the amount of public expenditures allocated to education and their ratio in relation to total State expenditure, have been determined, the annual financial allocations for education and their distribution between capital and current expenditures may be calculated by educational levels.

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Capital expenditures are, in turn, allocated to expenditures for construction (new works, substitutions, expansions, remodelling and repairs), furniture, equipment and maintenance.

The amount for each item is negotiated, in accordance with national and local priorities bearing in mind the share contributed by local communities. Finally, since needs generally surpass resources, priorities will have to be redefined or policies will have to be adjusted to the actual capacity of the national economy.

C. PRIORITIES

The concept of priorities basically arises as a consequence of responding with investment when needs surpass resources. In terms of physical projects, two types of priorities may be discussed:

> one, which relates projects to be implemented within a given plan to the exclusion of others; and
> another, which is a time priority that defines the sequence for investment in terms of time within the projects selected.

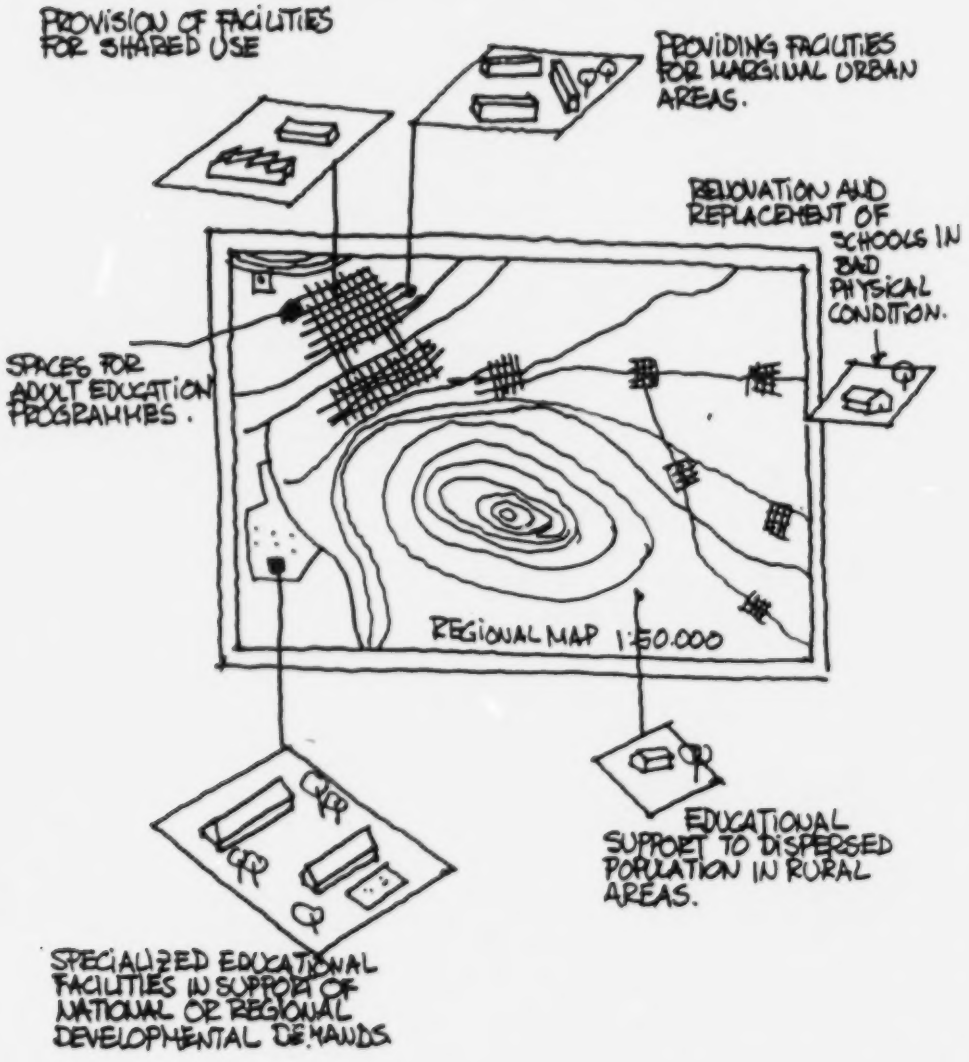
Needs, in terms of the physical works, respond to a different cause and should be quantified in order to establish ranges of urgency. *The unserved population should usually be considered the most urgent, if located in developing areas where marginalization is to be combated, not only in education, but also in housing, health and job opportunities.* In such cases, this parameter should be given due weight in establishing priorities coherently.

Furthermore, it is a question of *correcting regional disparities by providing unserved localities* with education centres, expanding buildings with excess enrolment or distributing it among new buildings located in the same area, etc.

Once parameters required to quantify the deficit have been established, several criteria may be set forth, for selecting the institutions in which investments will be made:

PRIORITIES

EXEMPLES OF POSSIBLE PRIORITIES


PROVISION OF FACILITIES FOR SHARED USE
PROVIDING FACILITIES FOR MARGINAL URBAN AREAS.
RELOVATION AND REPLACEMENT OF SCHOOLS IN BAD PHYSICAL CONDITION.
SPACES FOR ADULT EDUCATION PROGRAMMES.
REGIONAL MAP 1:50.000
EDUCATIONAL SUPPORT TO DISPERSED POPULATION IN RURAL AREAS.
SPECIALIZED EDUCATIONAL FACILITIES IN SUPPORT OF NATIONAL OR REGIONAL DEVELOPMENTAL DEMANDS

1) Use the funds available in a manner proportional to the needs identified per institution. This will ensure some investment for all institutions with a deficit, although it will make it impossible to meet the total needs of any particular institution.

2) Invest only in institutions whose deficit is above a fixed minimum. This has the drawback of not responding to the deficit of some institutions at all.

3) Begin by meeting the total needs of those institutions with the greatest deficit to the extent possible with the investment available. Any of these alternatives, in addition to others that may be proposed, have drawbacks, since a part of the deficit will always remain uncovered.

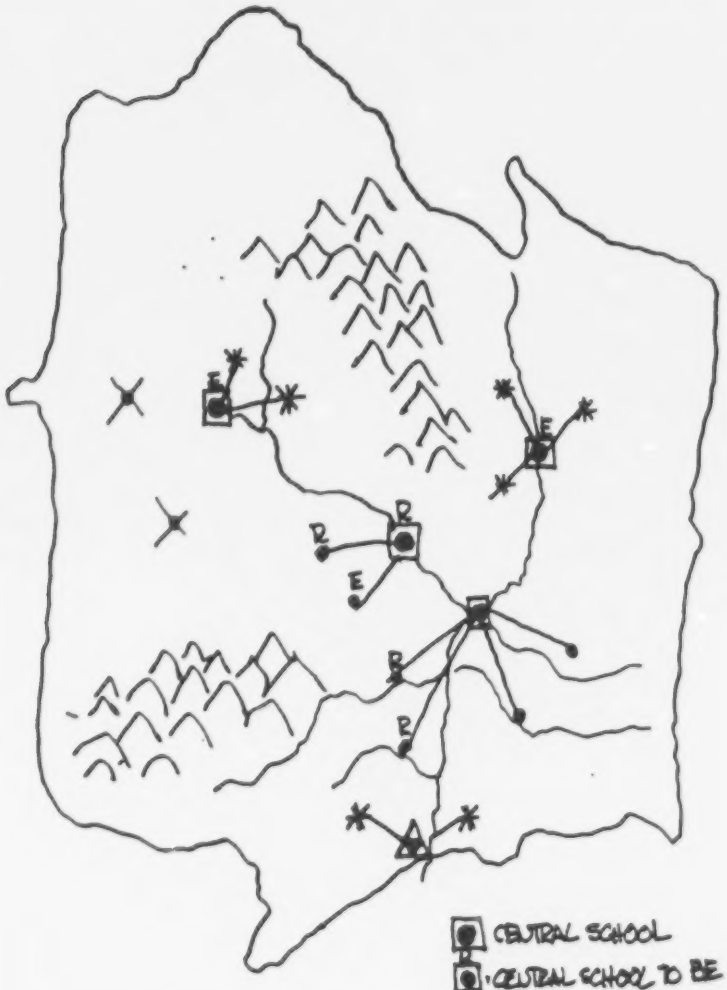
The remaining deficit may be postponed for future plans or attended to by resources, either from the community or with loans that provide financing for implementing works for periods of time agreed upon. Quantified priorities should be expressed through the educational map of the plan (educational map II) and in charts in which works per institution and type of works should be listed, together with the related costs and schedules for implementation.

D. EDUCATIONAL MAP II

As mentioned previously, educational map II is the document that shows the deficit of school buildings and the plan of projects to be carried out.

In contrast to educational map I, which shows a static image of the actual existing situation at a given time, educational map II is composed of a series of documents related to a dynamic process of a sequence of decisions that lead to meeting a deficit detected in the diagnosis stage. This process is iterative and seeks to balance needs and physical resources.

EDUCATIONAL MAP 2.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An analysis of the deficit in terms of physical infrastructure, is related to land and a graphic aid is required to visualize the catchment area of education centres, to detect unserved areas where it would be advisable to site new schools and to identify schools that may be expanded to extend their influence.

More precise knowledge of the deficit, together with all the information from the data bank, including educational map I, will be of help in determining priorities and implementation stages, as well as in localizing activities and classifying them, i.e. as new buildings, expansion of existing buildings or substitution of obsolete buildings.

SITING NEW SCHOOLS REQUIRES KNOWLEDGE OF THE CATCHMENT AREAS OF THE EXISTING SCHOOLS. One of the maps used to detect and visualize the unserved or poorly served areas of a territory is precisely the catchment area map. These maps may be structured by drawing a circle around each school equivalent in area to its enrolment. The dimen of the circle may be defined in units of equivalence arrived at by comparing the habitable area of the territory with the school age population, which gives a unit in square metres per school age inhabitant.

Measured in these units, the circles centred around each school represent the share of the school age population being served by the system and the area outside the circles is where the unserved or poorly served population are located.

The procedure provides a preliminary approximation for gaining knowledge of a problem that is complex and should be supplemented by analyzing socio-economic conditions and other factors that verify the findings of this first approach.

Depending on whether urban or rural areas are being dealt with, other catchment area maps of education centres may be used that will help to define the limits of influence set forth more precisely with concepts such as:

maximum distance-time between an education centre and the learner's home,

topographic or functional conditions that divide the territory, and

other factors that lead to proposing solutions that are better adapted to the actual circumstances in each situation.

Summarizing educational map II is a document in which the plan of activities to be carried out in each of the regions of a country should be clearly indicated, including both urban and rural areas. Such activities should include new works, expansions, substitutions or repairs, all quantified and with specific planning dates. This document will make it possible to structure the programmes of works with dates and costs, which serve as a basis for implementing the plan.

E. NATIONAL SCHOOL BUILDING POLICY

Having funds available to meet educational needs is not sufficient, since effective administrative organization also needs to be structured using the most advanced operational procedures to improve efficiency, reduce costs and adopt formulas to ensure the continuity of plans, objectives and standards for educational administration.

A national school building policy should be comprehensive and should include all educational levels.

This policy should indicate the guidelines to be followed in the distribution of national investment in school buildings, serving poles of development, marginal anddensely-populated areas and other decisive factors for determining priorities for a specific region at the national level.

Thus, it is recommended for the Ministry of Education to establish planning departments, to prepare comprehensive plans and to make a systematic and periodic evaluation to verify their implementation.

F. REGIONAL PLANS

Once the magnitude of the national needs has been determined on the basis of the objectives and goals of the educational plan and its consequent repercussions in cost and its respective budget allocations have been calculated, it is necessary to proceed to the distribution of available economic resources for each educational level at the state and municipal scale in both rural and urban areas.

For this purpose, a series of charts should be made in order to gather information regarding needs and resources in which the following information is incorporated:

- *Total population.*
- *Legal school age population.*
- *School demand per grade level.*
- *Enrolment one year after the plan is formulated.*
- *Deficit to be met (number of students).*
- *Amount of deficit to be met (obtained from the cost index per student).*

Filling out this type of matrix for each educational level and type, will provide for distributino the planned resources at the national level for each of the sub-national administrative divisions (e.g. state/provinces, districts, municipalities) of the country.

VI

IMPLEMENTATION

The school map and all the information on site availability and characteristics can be used to prepare a specific strategy and to select and acquire the land required for the new works foreseen in the plan.

At the same time, a position has been reached in which architectural briefs that translate requirements of educational activities into requirements for physical facilities may be prepared.

Architectural briefs are used to prepare designs, plans, specifications and cost analyses which help in the implementation of the works.

In order to implement the works efficiently, the proposed contracting system should be adapted to the different situations in relation to type; either rural or urban; to size, small or large; to location, isolated or accessible. Documents should be adapted to this concept.

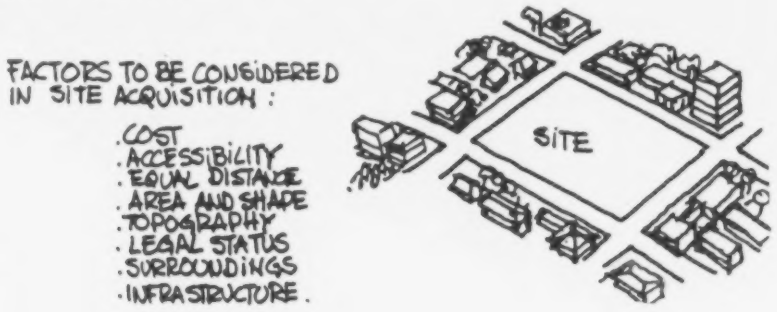
All the documents for each work, including plans, specifications, and contracts should be compatible with the specifications of annual work programmes regarding the type of work to be implemented and the cost and time for implementation.

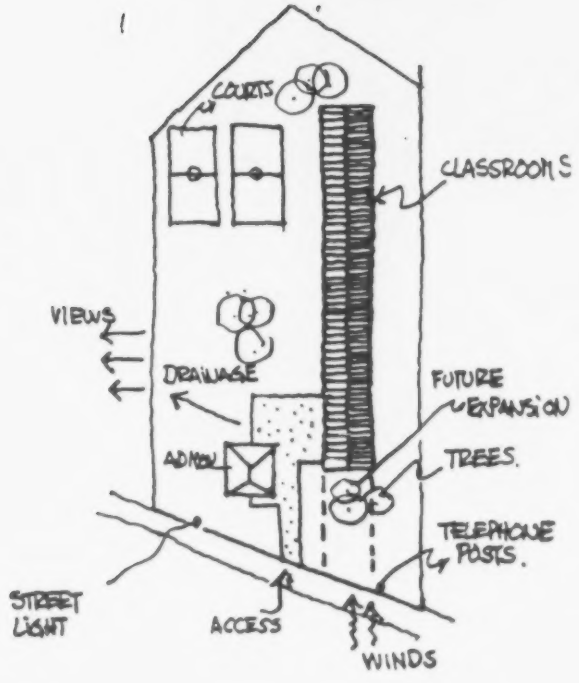
The works implementation stage is one in which the actual conditions are confronted and therefore more that at any other stage is vulnerable to unforeseen circumstances, which can modify plans. Thus, it is important to evaluate the works implemented in order to provide feedback for future plans so as to bring them closer and closer to the actual situation.

A. SITE SELECTION AND ACQUISITION

Some of the works included in a plan do not require new sites, since they are expansions or repairs that may be carried out in their present locations. In some cases, however, sites are insufficient for the expansion required and must be extended onto adjacent land, when possible.

In the case of new works, which may be replacements of inadequate buildings, or actual new buildings, new sites are generally required that respond to criteria such as: economy, accessibility, centrality or equal distance and capacity of the education centre.





a) Economy

The cost factor is undoubtedly one of the governing elements to be taken into consideration in the selection of a site. It is, however advisable to note that the optimum solution is not always to be found where land is least expensive.

Factors such as excessively expensive foundations required because of unsuitable subsoil conditions or the cost of providing infrastructure services, increase the cost of a site.

For schools located in densely populated areas where land values are high, there is a tendency to amortize costs through shared use of the site. This is not the optimum solution, but in certain cases, it is the only way to build schools in central areas where land is expensive.

Another solution geared towards lowering costs consists of concentrating certain services that require too much space in the school building, to another location, which provides services for several schools. This is possible with sports facilities, workshops and laboratories. Such planning presents the possibility of distributing services among several schools and reduces the investment in installations, in addition to decreasing the area required for the school site.

b) Accessibility and Centrality

The selection of a site for building a school is also influenced by accessibility.

Recommendable distances and time durations vary, in accordance with the urban or rural nature of the site, the population density, the size of the education centre, transport availability and service and the educational level, but, in any case, the site should meet certain criteria that will ensure easy access from the home to the education centre.

Two further criteria in locating a new facility would be:

i. a well-balanced geographical distribution of schools in a given area; and

ii. the centrality of a school in relation to the population it serves.

c) Other Factors

Sites should also meet a number of other requirements, which should be carefully examined before deciding to implement a school building programme. Such requirements include:

- legal status
- shape and dimensions
- orientation
- quality and type of access
- topography
- existing trees and buildings
- light, water, sanitation, gas and telephone infrastructure
- adjacent areas.

Once possible site alternatives have been determined, the option that presents the greatest advantages, not only from an economic standpoint, but also in terms of capacity, location, accessibility and so forth, should be chosen.

The availability of land may depend on sites that belong to the government, in which case it may be possible to exchange or reach a direct agreement between government organizations. If the land is privately owned, negotiations should be initiated with the owner to reach an agreement or, in special cases, expripriation procedures should be initiated.

In some cases, land is not available in the places indicated and it will be necessary to redesign programmes and seek alternative solutions, either through improved transport or student boarding facilities for sites far from the users or through increased height of buildings when the area is less than that recommended.

After selecting the site, acquisition procedures are started and these require constant follow-up, since such processes are usually lengthy and involve bureaucratic procedures. Land should be available before construction work is initiated; otherwise, delays in investments may occur with consequent economic losses for the government.

In the case of sites for primary schools where parents have a closer relationship with the institutions, it is feasible for the community to become involved in the acquisition of land, thus facilitating procedures and reducing investments.

E. ARCHITECTURAL BRIEFS

An architectural brief for a building, or set of buildings, may be defined as the programme for determining, calculating and organizing the facility requirements set forth by the educational process in terms of quantity and type. The basic purpose of the brief is to put educational problems into architectural terms for subsequent solution through the design and implementation of works.

For this purpose, a study of educational objectives is conducted, together with teaching content, means for imparting such education and the educational organization on the basis of which the facilities will be programmed and designed.

Educational activity is produced by the teacher and the student, either together or individually, using certain teaching means, and takes place within the framework of a given educational organization. Such factors are interdependent and sequential and are studied in order to reach valid conclusions for properly understanding educational activities.

Studying educational activities provides information on the general level, the philosophical bases and the conceptual foundation of the educational organization, and elements of teaching content.

A study constituting the preparatory steps for an architectural brief includes:-

1. Establishing a hierarchy of course groups and therefore of types of knowledge, skills and dexterity with which learners are provided.
2. Making the information required to understand the application of educational means for teaching and learning, available.
3. Understanding the educational significance that will be characteristic of each educational environment for its proper programming and design.

This study provides an understanding of educational activities and their consequences in terms of:-

1. Number of participants.
2. Degree of teacher participation.
3. Direction of student attention.
4. Degree of teacher and student mobility.
5. Physical distribution of the group.

Programming the school building consists of determining, calculating and specifying the space requirements evolving from the educational process.

The preparation of an architectural brief progresses through the following stages:

1. *Obtaining a typology of «simple» facilities and environments directly deduced from the educational activities that arise from an analysis of study plans and programmes.*

2. *Grouping of simple facilities or environments that are related.*

3. *Calculating the number of facilities required per type.*

4. *Organizing the programme elements on programming specification charts.*

In order to calculate the number of facilities required the following factors are taken into consideration:

1. Number of weekly periods during which the facility in questions is utilized (p).
2. Number of student groups (sections) that use the facility (g).
3. Total number of weekly work periods established in the plan of studies (t).
4. Admissible use factor for the facility in question (i).
5. Number of facilities required (n).

These factors are related as follows:

$$(n) = \frac{(p) \times (g)}{(t) \times (i)}$$

The number of weekly periods (p) in which the facility is used is obtained directly from the plan of studies. The number of groups (g) may be obtained by dividing the enrolment that is going to use the facility by the number of learners in each group.

The total number of weekly periods (t) is the percentage relation between the weekly time required from an

educational facility and its availability during the same period of time. The value (i) varies from 0 to 100 and is the empirical value that depends on the availability of teachers at the appropriate times and the degree of flexibility in which schedules are conceived.

For general classrooms and facilities with little specialization, a use factor percentage between 80% and 90% is considered acceptable; for workshops, laboratories and specialized facilities, a lower use factor that may vary between 60% and 70% is expected.

The elements of the architectural brief should be organized and made specific, bearing in mind its purpose is to guide the designer. Thus, systematizing data that has been researched is essential and of great importance in an architectural brief.

Such data include:

1. *Type of facility or environment.*
2. *Number of facilities or environments calculated.*
3. *Number of students who will use the facility.*
4. *Area required in square metres per student.*
5. *Partial area per facility or environment.*
6. *Total area.*

The information required on basic installations; furniture; teaching aids; acoustic, thermal and visual comfort conditions; etc. must be added to this information, in addition to the study of certain particular factors regarding the potential of the building industry, regional characteristics of manpower and materials available, all of which will make it possible to define the specific characteristics of the facilities programmed with greater precision.

To facilitate the calculation on the number and type of facilities, charts of concentrated information may be used, as indicated in the following example.*

a) VARIABLES REPRESENTED IN THE CHART

1. Courses (taken from the curriculum).
2. Education level (primary or medium).
3. Cycle (preprimary, primary, basic secondary or upper secondary).
4. Grade.
5. Number of groups per grade.
6. Weekly hours per grade and course.
7. Weekly hours per grade.
8. Weekly hours per course.
9. Total weekly hours.
10. Type of facility.
11. Weekly hours per course and type of facility. (Since some courses carry out different activities, it is common for the weekly hours of a course, to be divided into two or more different facilities; such is the case with physics, chemistry and biology).
12. Weekly hours per type of facility. (The hourly load to which each facility will be subjected).
13. Weekly teaching load per course. (This facilitates calculating the number of teachers required and their working hours).

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* The example discussed here relates to a comprehensive science laboratory. Though an architectural brief for primary school facilities would be much simpler, the complexities of developing a science laboratory give a better background for understanding all the steps in preparing a brief.

14. Total weekly teaching load. (This is usually greater than the total weekly hourly load (9) because some groups are divided into two or more subgroups that carry out different activities at the same time; in this case, what is saved in space is required in teachers, which benefits the learners through better teaching attention).

15. Measurement of groups that use each facility. (When a group is divided into subgroups in accordance with the comments in (14), the weekly hour load is not distributed, but repeated as many times as there are subgroups and this information should thus be included for each facility).

16. Number of facilities by type. (A value of i is established a priori for each facility and the number of facilities required to meet the proposed use factor is obtained; since i should be a whole number and the formula sometimes produces decimals, the whole number immediately above the decimal should be taken, which usually causes the effective use factor for facilities to be lower than expected).

17. Effective use factor for each facility.

18. Total number of facilities.

19. Use factor of all facilities.

20. Weekly hours available, indicating if there is more than one shift. (This is a reference value that has already been used in (16) and (17)).

21. Total enrolment. Indicate if there is more than one shift.

22. Enrolment by group.

23. Existing facilities by type.

24. Facilities to be built. This is obtained by subtracting (23) from (16); the results will be the base for structuring the list of facilities to be built at each of the sites.

b) COMPILED INFORMATION CHART:

LEVEL / CYCLE / GRADE / Nº OF GROUPS / COURSES (1)	(2) MIDDLE		(3) BASIC		LOAD BY COURSE	GENERAL CLASSROOM	AUDITORIUM	BIOLOGY LAB.	PHYSICAL SCIENCES CLASSROOM	LANGUAGE CLASSR.	PHYSICS LAB.	CHEMISTRY LAB.	ART WORKSHOP	MUSIC ROOM	INDUSTRIAL WORKSHOP	HOME ECONOMICS WORKS	SPORT FACILITIES	OUTDOOR SPACE	TEACHING LOAD
	7	(4) 8	9	(5)															
SPANISH																			
MATHEMATICS																			
BIOLOGY	(6)				(8)		(11)												(13)
GEOGRAPHY																			
HISTORY																			
FOREIGN LANGUAGE																			
PHYSICS																			
CHEMISTRY																			
CIVICS																			
ART EDUCATION																			
TECHNOLOGICAL EDUC.																			
PHYSICAL EDUCAT.																			
VOCATIONAL GUIDAN.																			
WEEKLY HOURS	(7)				(9)		(12)												(14)

X PART TIME (GIRLS, BOYS OR BOTH)

SIZE OF EACH GROUP (15)

WEEKLY HOURS AVAILABLE (20)	e		(16)															(18)
TOTAL ENROLMENT (21)	i		(17)															(19)
ENROLMENT BY GROUP (22)			(23) (24)															

C. BUILDING DESIGN

The building design is the response to the programme expressed in plans, specifications, records and models that will make the physical work possible.

It is the result of analyzing each of the proposed developments in the programme, bearing in mind the limitations imposed by each particular situation.

The relation between the design and the limiting socio-economic conditions makes it necessary for the teams responsible for the building design to participate more actively in the programming stage and, if they do not participate, at least to reach an overall understanding of the programme and the process leading to it. Technological advances provide the means to increase objectivity in methods for determining programmes and to make more precise responses to the increasing complex statements of needs. Systems engineering, new mathematics and cybernetics are some of the tools that open a new panorama of possibilities to those responsible for the building design.

The design team should analyze real and comparable facts and, before preparing the final documents for implementation of the project, an evaluation should be carried out by an interdisciplinary team composed of architects, engineers, educators and administrators. During this evaluation, a simulation model is used to discuss not only the *functionality* of the facilities in responding to educational requirements, but also their *flexibility* for absorbing possible expansions or changes in the utilization of facilities, the use of educational facilities for community activities and vice versa, in addition to other factors that may not have been developed sufficiently during the programming stage.

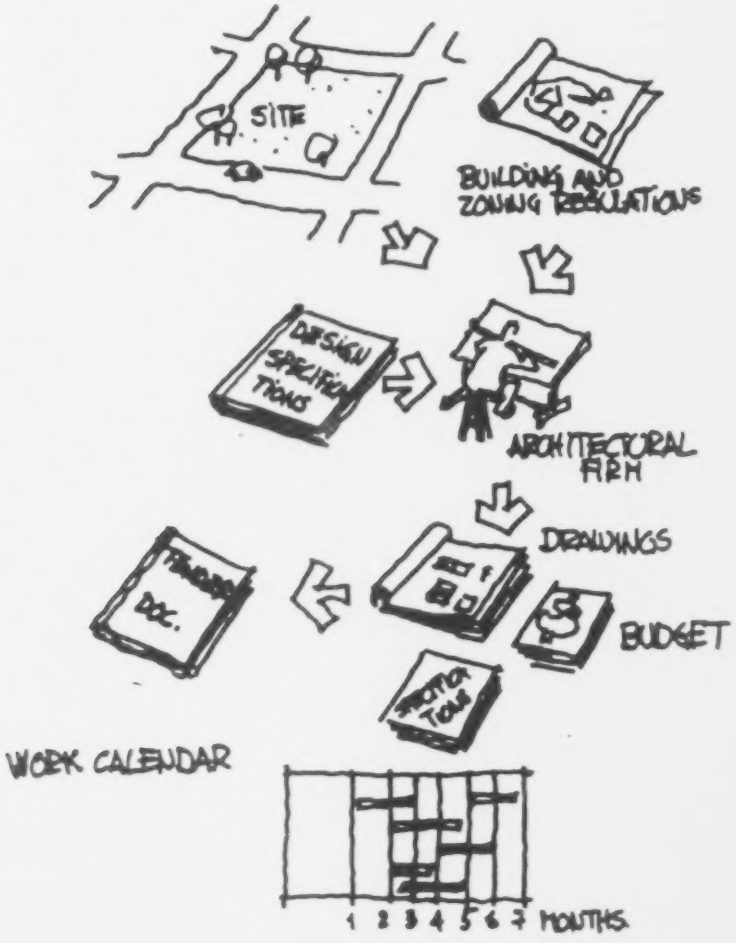
D. PREPARATION OF PLANS AND SPECIFICATIONS

The documents prepared for the construction, that is, plans, specifications, records and contracts, should be sufficiently precise and clear so as to provide the builder or community with the information necessary to carry out the project in accordance with plans.

The precision and clarity of such information will facilitate the task of supervision, avoid modifications and reduce costs.

****
* *
* *General requirements include: plans, vertical* *
* *sections and facades, detailed finishes with* *
* *precise notes, building details, site drainage* *
* *with specifications, structures, installation* *
* *drawings, construction records and* *
* *

contracts, all of which should be coherent, to a proper scale and, if possible, in standard sizes in order to make easily handled folders.



The documents required for the project are different from those required for informing governmental authorities of the design or for submitting a draft project for competitive bidding

E. CONTRACTING PROCEDURES

The contractual relation between the owner and the builder should be clearly defined with the responsibilities of each party specified.

A procedure for awarding contracts must be defined that not only seeks low costs, but also considers the balance between quality and cost.

In the case of the lowest bid being accepted, it is essential to verify and ensure the solvency of the firm being awarded the contract, as well as the precision of the bid.

When important bidding is opened, it is common for governments to use lists of prequalified firms in order to ensure that the firm awarded the contract is solvent.

Documents used for bids generally include not only plans and specifications, but also a basic list of elements in which unit prices are requested in order to forecast possible variations in costs.

In general, the construction firms include extra costs for each item. It is advisable, however, to request a separate list for outdoor projects such as accesses and connections for light, water and drainage in order to facilitate the analysis of building costs.

F. CONSTRUCTION

The building process is the set of steps that make it possible to implement the physical work on the basis of contractual documents such as plans, specifications, records and contracts.

The importance of the time factor in school building processes is becoming increasingly important, since teaching plans and programmes have very precise and planned schedules; such plans therefore demand having new schools built within specific dates in order to be finished when the school year starts.

National school building organizations should have properly developed capacities for the diverse specialized tasks involved. When the implementation of projects allows them to hire private building firms, they will thus be prepared to carry out external programming, which requires knowledge of the environment, of the degree of organization and responsibility of the construction companies, and of the technical, human and financial resources that such companies have available. Furthermore, they will have sufficient capacity to prepare and carry out internal programming when the policy decisions from above entrust them with constructing or reconstructing school buildings; or when the implementation system determines the authority for the direct administration of works.

No matter how well planned the construction is, the varying conditions of the environment, with regard to the availability of materials, labour conflicts, manpower performance, etc., cause uncertainties which have to be solved always choosing the best alternatives.
Thus, it is important to consider, determine and measure all building activities, both principal and secondary, that are involved in such projects; this includes the effects the various activities can have on each other and the relations of each activity to the project as a whole. This task of rationalizing and systematizing is the basis of modern operational methods that are provided by systems engineering.

Without scientific programming and control methods, it is becoming increasingly difficult to establish an order for the multiple and extremely varied activities involved in building programmes that are now based on complex short-term processes. Without the help of these methods, project management would be overwhelmed by the speed at which activities must be carried out and the uncertainty in making immediate decisions.

Network analyses of the work (using PERT for example) with estimates of timetables for activities and data provided by the calculation of these methods, supplement the specific and summarized information with which proper decisions can be made in every particular situation.

G. EVALUATION

The evaluation of the plan takes place by measuring or assessing the work actually carried out in relation to the parameters established.

The main objective is to provide feedback for future plans and to avoid errors that lead to increased costs.

When the process that has led to a work is known, it is advisable to use the same parameters that were used before in order to be able to adjust plans in the future.

In such cases, comparative charts may be prepared for each work item, among the parameters used, and the results obtained, concluding with related observations and recommendations.

In other cases, it is a question of evaluating existing works without knowledge of the process that produced them, in this case it is necessary to apply some evaluation methodology such as:

1. Opinion surveys among the users, either partially, or in total of the population involved.

2. Real field research, analyzing and grading a list of basic concepts that the facilities and sites where the buildings are located, should meet.

3. Simulated field research, analyzing the results of a simulation model structured on the basis of certain ideal conditions that the facilities and sites should meet.

An evaluation should not only tend to discover errors or negative factors in the plans, but should also identify the positive elements, since all works may provide knowledge that we must learn to recognize.

APPENDIX

INFORMATION TO BE OBTAINED ON INVENTORY QUESTIONNAIRE

A) GENERAL SCHOOL BUILDING DATA

. Location:	District, locality, urban or rural area, code, name, address.
. Property:	National, private, community.
. Original purpose:	Constructed as a school, adapted as a school or constructed for another purpose.
. Operations:	Number of schools that use the building, morning, afternoon and/or night shifts.
. Other operations:	Community centre, assemblies, recreation, religious activities, hurricane shelter.
. Construction:	Party responsible (public works, private, community, religious institution).
. Date:	Date of construction or indicate if under construction.
. Physical conditions:	Good, average or bad.

B) PARTICULAR DATA

. Number:

. Name:

. Code:

. Tenure:	Owned, lent, rented.
. Monthly rent:	
. Administrative dependence:	National, private.
. Number of buildings:	One, two or more.
. Enrolment by level, shift and sex:	

C) SPECIFIC DATA

i. Basic information

. Land:	Total area, constructed area and covered area.
. Possibilities for expansion:	
. Basic services:	Drinking water, well, river or stream, rain water collectors, drainage, septic tank, electric energy, energy plant, telephone.
. Fence:	Complete, incomplete, none.
. Sanitary services:	Toilet facilities, wash basins, individual and collective urinals, showers, earth closets, sinks, drinking fountains (indicate the physical condition of each service as good, average or bad).

ii. Construction system

. Structure:	Concrete, metal or wood.
. Roofs:	Concrete, metal sheet, asbestos sheet, thatched palm.
. Walls:	Concrete block, brick, wood, stone, wattle and daub.
. Floors:	Concrete, tile, wood, earth.

. Windows:	Wood, metal, aluminium.
. Finishes:	Walls painted, wall and floor tiles, ceilings.

D) SPECIFIC DATA ON EDUCATIONAL FACILITIES

i. Academic facilities

Common classrooms, multipurpose spaces, laboratories, light workshops (home economics, typing, etc.), heavy workshops, resource centre (library), unadapted classrooms, etc.: quantity, length, width, height, area, physical condition (good, average or bad), and construction system.

ii. Administrative facilities

Offices and services: idem.

iii. Supplementary facilities

Auditorium, gymnasium, storage area, bathrooms: idem.

iv. Sports facilities (outdoor)

Basketball, volleyball and tennis courts, field and track facilities, soccer and baseball fields, playgrounds: quantity and physical condition (good, average or bad).

v. Annex facilities

Boarding accommodation, janitor quarters, teacher accommodation: physical condition; agricultural and livestock facilities, areas for planting and for raising animals.

vi. Inside comfort conditions

Acoustics (noise), thermal (climate), natural lighting, artificial lighting, natural or mechanical ventilation, sun penetration (protection), first-aid services, hygiene and cleanliness, safety: comfort conditions (good, average or bad) for each item.

vii. School equipment

Workshops (tools, equipment, etc.), laboratoires (installations, equipment, etc.), specialized spaces (furniture, equipment, etc.), auditorium (film and sound equipment, etc.), physical education facilities (balls, nets, etc.), sound equipment (general), teaching aids (maps, rulers, etc.)and flags:conditions of each item (good, average or bad).

E) SCHOOL FURNITURE

i. For students (of school age and adults)

Chairs, individual tables, double tables, double benches, desks, chair desks (metal or wood), etc.: quantity and condition.

ii. For teachers

Chairs, tables, desks, etc.: idem.

iii. General furniture

Moveable chalkboards, shelves, bookcases, filing cabinets, chairs, meeting tables, etc.: idem.

F) INFORMATION ON TEACHING AND ADMINISTRATIVE STAFF

Name, position, level of instruction and grades taught, years of service, degree or diploma.

G) SKETCH OF THE SCHOOL FACILITIES INCLUDING THE ENTIRE PREMISES

H) SUPPLEMENTARY DATA

i. Students (school age and adults) (indicate quantities for each item)

. Place of origin:	Community, vicinity, other community.
. Travelling time:	From the community, vicinity or other community, indicate if by bus, on foot or by other means.

. Type of transport:	Governmental or private.
. Native language:	

ii. Teachers (indicate quantities in each item)

. Residence:	In the community, vicinity or other community.
. House:	Idem., indicate if owned or rented.
. Services in the teacher's house:	Idem., indicate the number of bedrooms, living rooms, kitchens and bathrooms.

iii. The school and its environment

. Location:	Within the community, outside the community.
. Means of access:	Street, highway, road, river.
. Associations organized in the school:	Parents, teachers, boy scouts, brigades, religious societies.
. Maintenance and repairs:	Communities, parents, teachers, public works, school.
. Student absenteeism:	Cause, time and amount.
. Student drop-outs:	Percentage per educational level and per grade.

iv. The Community

. Type of settlement:	Age, permanent or temporary.
. Approximate population:	
. Main economic activity:	

. Services available:	Drinking water, electricity, telephone, drainage, sewerage systems, postal service, medical service, transport.
. Natural disasters:	Type, magnitude and frequency (cyclones, earthquakes, tsunamic floods, etc.).
. Facilities available potentially suitable for education:	Churches, theatres, community halls, etc.

v. Observations

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